REPORT

OF THE

COMMISSIONERS

OF THE

QUEBEC, MONTREAL, OTTAWA AND OCCIDENTAL RAILWAY

ON THE

OPERATIONS OF THE COMMISSION, THE EXTENT AND NATURE
OF THE WORKS DONE UP TO THE 1st DECEMBER 1877

ALSO

REPORTS OF MESSRS. LIGHT, PETERSON AND FLEMING

ON THE DIFFERENT ROUTES BETWEEN

MASKINONGÉ AND MONTREAL *VIA* BOUT DE L'ISLE AND TERREBONNE,

WITH APPENDICES AND MAP

QUEBEC
PRINTED BY AUGUSTIN COTÉ & Co
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To His Excellency,

The LIEUTENANT-GOVERNOR,

IN COUNCIL.

The Commissioners appointed under the authority of the Act of this Province, 39th Vict., chap. 2, intituled : "An act respecting the construction of the Quebec, Montreal, Ottawa and Occidental Railway," have the honor to submit their report upon the progress of the works executed upon the said Road, up to the first day of December instant.

EASTERN SECTION.

This includes that part of the Road lying between Quebec and Montreal, and the Piles Railway.

The grading on this section is almost finished from Quebec to the river Maskinongé : a distance of one hundred and two miles.

All that remains to be done is to fill up the place now traversed on trustles on Baribeau's island, in the river "Ste. Anne," and the levelling around the stations for sidings.

The masonry, with the exception of about three hundred cubic yards of second class work, which remains still to be done, is all finished.

The wooden bridges are also finished, with the exception of those over the River "Du Loup" and Maskinongé, and several other culverts of slight importance, which are now being built.

All the iron bridges are completed and the track is laid from Quebec as far as *Petite Rivière Yamachiche*, including the greater part of the sidings. Track is being laid towards Maskinongé.

About thirty seven per cent of the ballasting has been placed between Quebec and Maskinongè.

Passenger stations and freight sheds at Quebec and Three Rivers are either completely built or well advanced.

Finally the Road is sufficiently advanced to allow of the regular running of passenger and freight trains between Quebec and Yamachiche village, in the county of St. Maurice.

From the River Maskinongé to Terrebonne—a distance of forty-seven miles,—more than fifty per cent of the grading is finished, and ten per cent of the first class masonry. One half of the stone necessary for the bridges, has been placed where required, and the track has been laid on a distance of ten miles from the Joliette Railway, towards the River "L'Assomption."

All the materials required for this portion of the line, are being prepared and the work will be finished early next autumn.

As to that portion of the line from Terrebonne to Montreal—a length of 11.56 miles,—it is not yet located.

The cities of Quebec and Montreal and the other municipalities not having paid any thing on their subscriptions, since the Railroad was handed over to the Government, the resources at the disposal of the Commissioners did not allow of their beginning work on this Section.

PILES RAILROAD.

On this Branch, which is 26½ miles in length, the grading is almost completed.

Forty per cent of the masonry is completed, and the track is laid and ballasting finished for a distance of nine miles and three quarters from the junction with the main line to "Rivière au Lard." All the rails and fish plates requisite for the Road, have been purchased and delivered on the line, and so soon as the bridge on the *Rivière au Lard* is completed, the track may be laid as far as *Rivière Noire*, six miles from the *Grandes Piles* Fall, in the river St. Maurice, the northern terminus of the Road.

The proportion of the work done on this Branch, is 58.27 per cent.

THE LOCATION OF THE LINE BETWEEN MASKINONGÉ AND TERREBONNE.

In the beginning of the year 1875, several months before the transfer of the Road to the Government of this Province, representations were made to the Directors of the North Shore Railway Company, on behalf of the Counties of Joliette and Montcalm and of the town of Joliette, that the location should be altered and the Road made to pass by Joliette. The delegates from these localities even offered to make the explorations at their own expense, to prove the superiority of the projected location.

The Company consented to reconsider the location and to take into consideration the advantages and disadvantages of the new location, on condition that the expenses of the exploration should not be borne by the Company. The exploration was made under the direction of Mr. George Bemister, Engineer, of Montreal, and a report of the result presented to the municipal councils of the towns of Joliette and of Terrebonne and to the parties interested,—then submitted to the Directors of the said Company and by them referred to their Engineer, by resolution dated the 14th August 1875.

Before any decision was taken by the Company, the Road passed into the hands of the Government, and the Commissionners, in order to carry out the agreement made by the Company with the counties of Joliette and Montcalm and the town of Joliette, referred Mr. Bemister's report to their Engineer, Mr. Light, who again looked into the question.

A complete survey of the ground was made and was followed by a report from Mr. Light, in which he objected to the line through Joliette and recommended another line passing to the south of Joliette and to the north of the old line, running straight from St. Barthelemy to Terrebonne.

Mr. Light's reasons for recommending this line, are given at length in his accompanying report, but the undersigned deem it advisable to quote here this portion of his report :—

" No. 4 or " Red line throughout " diverges from the Shore line, between " Maskinongé & Berthier, passing ¾ of a mile further North of Berthier, and " thus better avoiding the *overflowed lands.* It runs, in one continuous straight " line, 38 miles to Terrebonne. Between Terrebonne and Hochelaga, there are " two easy curves of upwards of a mile radius. With the exception of the " Rivière " des Prairies " crossing, where the works are heavy, this line is simple and " easy to construct, grades no where exceeding 26 feet to the mile, in both di- " rections ; it could be worked with extreme speed and economy.

" Its total length is 58.56 miles, or 3.15 longer than the Shore line, but, owing " to its unusually straight and level nature, and the fact of its encountering " no draw-bridge to delay trains, it could be worked with greater safety, speed " and economy than the Shore Line."

" It has but 4 deep water foundations at " Rivière des Prairies," against " *twelve* on the Shore Line, at " Bout de l'Isle ". These foundations are the " key of the work and govern the time of completion. Practically, the fewer " there are of them, the sooner can the line be built, and interest of money, " during construction, saved : *a serious item not to be overlooked.*"

" This Line has also 1000 feet less Iron *truss* Bridging, than the Shore Line."

" Its total cost is $1,140,110 or $89,376, (*) less than the Shore Line, bringing " both to the same standard of excellence as regards grades, the reduction of " which grades on the Shore Line, to equal the direct Line, amounts to $44,800. " of this difference (See detailed estimates appendices 6 and 7)." (**)

" If one continuous through line to Montreal is to be built, this is the line " I recommend. It should, at any rate, be adopted from Maskinongé to " Terrebonne."

Mr. Light's report was referred by the Commissioners to Mr. P. A. Peterson, and, as the opinion of the latter differed from that of Mr. Light, the Commis-

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(*) According to the more recent estimates made by Mr. Light, the cost of this line is reduced to $1,094,537.00, and that of No. 1 line is increased to $1,298,986.00 ; making a difference in favour of the line through Terrebonne, of $204,449.00.

(**) These appendices are annexed to the accompanying report of Mr. Light.

sioners decided to submit the question to Mr. Walter Shanley; but, as this gentleman could not undertake to look into it, it was finally referred to Mr. Sandford Fleming; and, as he concured with Mr. Light in recommending the line going straight from St. Barthelemy to Terrebonne, namely: the line marked No. 4 on the plan accompanying Mr. Light's report, the Executive Council adopted this line by Order in Council dated 29th March, 1877, on the report of the undersigned, dated the 22nd of the same month.

The total cost of this exploration and of locating the line, between Maskinongé and Terrebonne, is $13,883.00, of which amount about $4,000 would have been required to be expended on the *Bout de l'Ile* line, before the works could be begun, and this reduces the actual amount of expense incurred by this exploration, to $9,883.00: and, as to the $4,000, they should be charged to the contractor.

The whole line completed from Quebec to Montreal, passing through Terrebonne, (Piles Branch not included,) will cost, according to Mr. Light's estimate, the sum of $4,518,657.89; which makes an increase of $202,657.89 on the amount of Schedule B annexed to the contract.

However, this increase would have been greater on the *Bout de l'Ile* line,—as established above,—from having to raise the Road above the level of the inundations caused by the ice-jam at Berthier, and to raise the bridge at *Bout de l'Ile* and its approaches, so as to avoid the draw-bridge and thus render this line similar to that now being built. This increase, according to the new estimate of Mr. Light—already cited,—would be $204,449.00; this would make the total cost of the line through *Bout de l'Isle*, $4,723,106.89.

The proportion of work done and of material supplied on this line, is 77.68 per cent, and on the Piles Road—58.27 per cent. The proportion on the main line and the Branch line combined, is 76 per cent as shown by the accompanying statement.

WESTERN SECTION.

It runs from Montreal to Aylmer, and includes the Branch line to St. Jérôme.—

On this Section, 96 per cent of the grading, comprising rock-excavation, is finished; there only remain 92,300 cubic yards to be done towards enlarging and raising the embankment and finishing the public roads and farm crossings. The masonry of the first and second class is also finished, with the exception of the copings of some culverts, which were removed to allow the snow ploughs to pass, and which are to be replaced, and also a few culverts in dry masonry as well as the ends of some culverts, built by the old Company and which have to be rebuilt.

The track has been laid for a distance of 117½ miles, from Montreal to Hull, and on the whole of the St. Jérôme Branch,—a distance of 13¼ miles. The main line, from Montreal to "Rivière Rouge" (60 miles) is all ballasted, excepting five miles; and from "Rivière Rouge" to Papineauville—a distance of 17 miles,—half the ballasting is done; and from Papineauville to Hull, there is no ballasting.

At present the stations and turntables are in course of construction, and will soon be finished.

Passenger and freight trains run regularly between Montreal and Hull.

This Road can be entirely completed by the first of September next; but it is already in such an advanced stage, that the contractor has opened it for traffic.

The Contractor of this Road was not able to carry out what he had undertaken, by his letter of the 16th March 1876, to complete the Road for the sum of $2,000,000, and to leave $308,000, plus five per cent on the two million dollars, to be deducted from and retained on the monthly Estimates, according as the works progressed, to refund the advances made to him to pay the debts he owed to the sub-contractors and to the laborers employed in the construction of the Road, and to the Jacques-Cartier Bank.

The reduction which the arrangement entailed in the prices set down in the schedule annexed to the contract, has been such that the prices were no longer sufficient to pay for the cost of the work, and that the Contractor, after having struggled during several months, viz.: up to December 1876, found himself indebted to his sub-contractors, laborers and advancers in a sum exceeding $115,000, and utterly unable to carry on work any longer under this arrangement.

The Commissioners laid these facts before His Excellency, the then Lieutenant-Governor, in a report dated the 13th December 1876, and asked for authority to secure and pay to the sub-contractors the value of their work and materials. This power was granted to them by the 40th Vict., chap. 4, SS. 10 and 11. In virtue of this authority, the Commissioners have, since, supplied the Contractor with the exact amounts necessary to pay for the work done and materials supplied by the sub-contractors—the prices of which seemed reasonable, and they took care that the latter were regularly paid, although to effect this, the amount of the monthly Estimates had to be exceeded.

From these facts, it results that there is no longer any hope of being able to retain, on the contract price, the amount which the Government paid to the Jacques-Cartier Bank, as it was obliged to do, according to the terms of the contract with the Montreal, Ottawa and Western Railway Company, as the undersigned have mentioned in their report of the 16th March last, and the amount of advances made to the Contractor, to pay the debts which he owed for work done on the Road, and those since made to him to enable him to carry on the work

It must not be forgotten, however, that the Road could not be built for the contract price agreed upon between the Government and the Contractor. In the first place, a considerable portion of the work had been done before the date of this contract, at a time when labor and materials were much dearer; then, the cost of the lands required for the Road, which had been put down in the schedule at $150,000, will be increased to $436,000; further, the quantities of work given in the schedule, are insufficient and will be considerably exceeded; and finally, a considerable part of the masonry done by the old Company, had to be rebuilt. All these causes combined have helped to increase the cost of the work and to put the Contractor in his previous and present difficulties. The proportion of work done on this part of the Road, up to the first of December instant, is 83.92 per cent.

GENERAL STATE OF THE WORKS ON THE WHOLE LENGTH OF THE ROAD.

The work, on every part of the Road between Quebec and Aylmer, is of the best quality and, when finished, the Road will compare favorably with the best Roads in the Dominion of Canada. In December 1876, the several subsidies granted by the Legislature for the construction of the said Roads, being all expended, with the exception of $19,500, and the municipalities having up to that time neglected to pay their subscriptions, the Commissioners obtained from the Provincial Government several advances which, on the first of December instant, amounted to $2,345,000. on bonds which they were empowered to issue to the extent of three millions of dollars, by Act 39th Vict., Chap 2. This loan was made out of " The Consolidated Railway Fund," under the provisions of the Act 40th Vict., Chap. 2, Section 4.

The Commissioners have received, in all, from the Government, up to the 1st December instant				$5,623,969	90
NAMELY :					
On Subsidies		$3,278,969	90		
Loan on their bonds		2,345,000	00		
Out of this sum, they have paid :—					
1o. To the Honorable T. McGreevy		2,992,890	11		
2o. To Mr. Duncan Macdonald		2,568,013	82		
3o. Expenses of Commission, including salaries of Commissioners and their employees, salaries and expenses of two Chief Engineers, and the expenses of surveys between Maskinongé, Terrebonne and Montreal, and between Alymer and Quio River	$71,567.04				
Less : amount furnished by contractors according to their contracts	19,358.42				
		52,208	62		
Suspense account		2,018	93		
Balance in Bank		8,838	42		
				$5,623,969	90

On the 1st December instant, Hon. Thos. McGreevy had received on his contract			$3,362,370	26
NAMELY :				
From the North Shore Railway Company, coming from the Government of the Province of Quebec, and from the subscription of the city of Quebec	364,480	15		
From the Commissioners	2,992,890	11		
From the Government, by amount paid for a note of the North Shore Railway Company	5,000	00		
			$3,362,370	26

At the same date Mr. D. Macdonald had received on his contract :			$3,818,615	80
NAMELY :				
From the Northern Colonization Railway	793,452	03		
From the Commissioners	2,568,013	82		
From the Government, amount paid to the Jacques-Cartier Bank.	400,000	00		
From the Government, by amount paid to the Montreal, Ottawa and Western Railway Company	57,149	95		
			$3,818,615	80

At the same date the total expenditure on the Quebec, Montreal, Ottawa and Occidental Railway, was			$7,235,213	61
NAMELY :				
Paid to the Hon. T. McGreevy	3,362,370	26		
Paid to Mr. Duncan Macdonald	3 818,615	80		
Paid expenses of the Commission, not including the amount furnished by contractors according to contract	52,208	62		
Suspense account	2,018	93		
Total expenditure on the Road			$7,235,213	61

On the first instant, the funds still on hand available for the completion of the Road, were :

1. To balance of subsidies granted by the Legislature	357,000	00		
2. To balance of the subscriptions of the cities of Quebec and Montreal	1,510,355	38		
3. Other municipal subscriptions	459,000	00		
4. Balance on loan of $3,000,000.00	655,000	00		
Total			$2,980,355	38

At the same date the sums remaining to be disbursed to complete the Road, were approximately the following :—

Approximate cost of the line between Quebec and Montreal (including $416,387.75 for the Piles Road)		$4,935,045	44		
Less : amount paid to the Hon. Thos. McGreevy to the 1st Dec. 1877.		3,362,370	26		
Balance still payable				$1,572 675	18
Telegraph line on the Eastern Section				15,000	00
Approximate value of the works remaining to be done and materials to be supplied, on the 1st December instant, on the Western Section, to complete the works according to contract, including rolling stock and the balance required for the purchase of lands				689,280	80
Approximate cost of the Road above Aylmer				600,000	00
Station in the city of Montreal, including land		250,000	00		
Less : the amount in the schedule for the station at Montreal	20,000.00				
And the approximate value of the land which the contractor of the Eastern Section is obliged to furnish	40,000.00				
		60,000	00	190,000	00
Contingencies				50,000	00
Total				$3,116,955	98

The annexed tables show the balance sheet of the Commission on the first December instant,—the proportion of work executed on the said Road at the same date,—the amount collected and to be collected at the same date on the various subsidies granted to the said Road and on the said loan.

The whole respectfully submitted,

H. G. Malhiot,
Chairman.
Geo. Irvine,
E. Chinic,
Commissioners of the Q. M. O. and O. Railway.

Quebec, 31st December, 1877.

BALANCE sheet of the Commission of the Quebec, Montreal, Ottawa and Occidental Railway, to the 1st december, 1877.

RECEIPTS.	$ cts.	EXPENDITURE.	$ cts.
Amount paid to Mr. Duncan Macdonald by the M. O. and W. Railway Company, coming from the Government, the Corporation of Montreal and from other sources....................	793,452 03	Paid to Mr. D. Macdonald on account of his contract by the M. O. and W. Railway Company..............................	793,452 03
Amount paid to the Honorable Mr. McGreevy by the North Shore Railway Compy, coming from the Government and the Corporation of Quebec..........	364,480 15	Paid to Hon. Mr. McGreevy on account of his contract by the North Shore Company..........	364,480 15
The North Shore Company's note paid by Government............	5,000 00	North Shore Company's note paid by Government..............	5,000 00
Amount paid to the Montreal, Ottawa and Western Railway Company by the Government, under the contract between the Government and the said Company, dated the 16th november, 1875..................	57,149 95	Amount paid by Government to the M. O. and W. Railway Company and to the Jacques-Cartier Bank..........................	457,149 95
Amount paid to Jacques-Cartier Bank by the Government.......	400,000 00	Amount paid by the Commissioners :—	
Received from Government :		To. Mr. Macdonald....................	2,568,013 82
On Subsidies........$3,278,969.90		To Hon. Mr. McGreevy..............	2,992,890 11
Advances on bonds. 2,345,000.00		Expenses of the Commission, &c.	52,208 62
		Suspense account....................	2,018 93
	5,623,969 90	Balance in bank.....................	8,838 42
	$7,244,052 03		$7,244,052 03

Quebec, 31st december 1877.

QUEBEC, MONTREAL, OTTAWA AND OCCIDENTAL RAILWAY.

STATEMENT shewing the proportion of the principal items of work done and materials delivered on the Eastern Section, to the 1st december, 1877.

ITEMS.	Quantities to be done or supplied according to the contract schedule.	Quantities done or supplied.	Proportion, per cent.	Quantities to be done or supplied from Quebec to Hochelaga *viâ* Terrebonne.	Proportion, per cent.
Earth Excavation	2,014,200 c. y.	1,999,930 c. y.	99.29	2,746,280 c. y.	72.82
Rock "	21,679 "	6,868 "	31,68	13,158	52.20
Masonry, 1st class	25,115 "	24,135 "	96.09	38,845	62.13
" 2nd class	14,000 "	8,966 "	64.04	12,127	73.93
Steel rails	13,922 ton.	13,922 ton.	100.00	....	100.00
Fish plates, &c	1,292 "	1,147,01 "	88.77	....	88.77
Iron bridges	5,326 ft.	2,912 ft.	54.67	4,289 ft.	67.90
Wooden bridges	3,296 "	1,616 "	49,00	....	49.00
Clearing, &c	380 acr.	348.22 acr.	91.63	....	91.63
Track laying	166 mil.	91 mil.	54.82	....	54.82
Total proportion :					
Estimated cost of Main line	$4,361,176.00*	$3,510,306.88	80.60	$4,518,657.89	77.68
Piles Branch	416,387.55	242,652.35	58.27	....	....
Main line and Piles Branch	$4,777,563.55	$3,752,959.23	78.55	$4,935,045.44	76.00

Quebec, 31st December 1877.

(*) This sum includes the contract price	$4,316,000.00
Plus, the amount of *extra* work authorized by Order-in-Council.	45,176.00
	$4,361,176.00

QUEBEC, MONTREAL, OTTAWA AND OCCIDENTAL RAILWAY.

STATEMENT shewing the proportion of the principal items of work done and materials delivered on the Western Section, up to 1st December, 1877.

ITEMS.	Quantities of the schedule annexed to contract.	Quantity made or supplied.	Proportion. P. C.	Quantity necessary to make the Road.	Proportion. P. C.
Earth Excavation	1,916,000 c. y.	2,330.462 c. y.	121.63	2,427,129 c. y.	96.00
" rock	60,000 "	82,668 "	137.78	85,963 "	96.16
Masonry, 1st class	29,840 "	31.382 "	105.16	31,517 "	99.57
" 2nd class	5,400 "	5,991 "	110.95	6,277 "	95.44
" dry	10,900 "	12,564 "	115.26	12,975 "	96.83
Steel rails	10,912 ton.	10,912 ton.	100.00	10,912 ton.	100.00
Iron rails	2,125 "	2,459.71 "	115.75	2,459.71 "	100,00
Spikes	435 "	391.46 "	90.00	453 "	86,40
Fish plates	650 "	650 "	100,00	650 "	100.00
Track laying	146½mil.	131.10 mil.	89.46	146.55 mil.	89.46
Total estimated cost	$3,601,649.95	$3,430,533.35	95.25	$4,087,950.27	83.92

Quebec, 31st December 1877.

QUEBEC, MONTREAL, OTTAWA AND OCCIDENTAL RAILWAY

STATEMENT shewing the proportion of work done on the Road from Quebec to Aylmer, including the Piles and St. Jérôme Branches, up to 1st December, 1877.

Total cost of Road, estimated at	$9,023,013 71
Value of work done	7,183,492 58
Proportion	79.61 per cent or 4/5.

Quebec, 31st December 1877.

QUEBEC, MONTREAL, OTTAWA AND OCCIDENTAL RAILWAY.

STATEMENT of grants to the Railway.

	$	cts.	$	cts.
The various appropriations made by the Legislature of the Province of Quebec, and municipalities for the construction of the Quebec, Montreal, Ottawa and Occidental Railway, are the following, that is to say :				
Subsidy granted to the North Shore Railway Company by the act 37 Victoria, chapter 2.	1,248,634	00		
Subsidy granted to the Montreal Northern Colonization Railway for the Railroad from Montreal to Aylmer, including the St. Jérôme Branch, by the same act	751,366	00		
			2,000,000	00
Subsidy granted to the same Company for the Road from Aylmer to Deep River, the same proportion per mile as that for the Road from Montreal to Aylmer, viz : $6,000.00 per mile for 92 miles			552,000	00
Subsidy granted to the Quebec, Montreal, Ottawa and Occidental Railway, by the Act, 39 Victoria, chapter 2			2,327,000	00
			4,879,000	00
To be deducted—5 per cent on the $2,000,000 granted by the act 37 Victoria, chapter 2, for discount on provincial bonds sold in England			100,000	00
Available balance			4,779,000	00
Paid by the Government to the North Shore Railway Company, out of the subsidy granted by 37 Vict. Chap. 2,	221,480	15		
Paid by the Government amount of a note of the above mentioned Company	5,000	00		
Paid by the same to the Montreal, Ottawa and Western Railway Company on the subsidy granted to this Company by the said act 37 Victoria, chap. 2	459,400	00		
Paid by the same to the said Company on the said subsidy by virtue of the contract between the Government and the said Company, passed before Ls. N. Dumouchel, N. P., on the 16th Nov., 1875	57,149	95		
Paid by the Government to the Commissioners on the said subsidy and out of the appropriation voted by act 39 Vict. Chap. 2, s. 41	3,278,969	90		
Paid by the Government to the Jacques-Cartier Bank in discharge of Duncan Macdonald	400,000	00		
			4,422,000	00
Balance remaining on the said subsidies			$357,000	00
Carried over			$357,000	00

QUEBEC, MONTREAL, OTTAWA AND OCCIDENTAL RAILWAY.

STATEMENT OF GRANTS IN FAVOUR OF THE RAILWAY.—(*Continued.*)

		$	cts.	$	cts.
Brought forward				357,000	00
Subscriptions of the cities of Quebec and Montreal		2,000,000	00		
Less: amount received from the Corporation of Montreal by the Montreal, Ottawa and Western Railway Company	$346,644.62				
Less: amount received from the Corporation of Quebec by the North Shore Railway Company	143,000 00	489,644	62		
		1,510,355	38		
Amount of other municipal subscriptions mentioned in Schedule A annexed to the act 39 Victoria, cap 2		459,000	00		
Balance of municipal subscriptions				1,969,355	38
Loan authorized by the act 39 Victoria, cap. 2		3,000,000	00		
Less: advances made by the Quebec Government to the Commissioners on the loan		2,345,000	00		
Available balance				655,000	00
Total				$2,981,355	38

REPORT

OF

MR. A. L. LIGHT,

ON THE

SURVEYS MADE IN THE SUMMER OF 1876,

BETWEEN MASKINONGÉ AND HOCHELAGA.

QUEBEC, 17th January, 1877.

To the Commissioner of the Q. M. O. & O. Railway.

GENTLEMEN,

I have the honor to report on the explorations made during the past season, by your directions, between Maskinongé and Hochelaga. A map is appended, shewing the main lines surveyed and also the probable connections. The main lines all begin at a common point near Maskinongé, and terminate similarly at Hochelaga. For convenience of reference, the lines have been numbered on the map 1, 2, 3, 4, 5 and 6. I propose describing them briefly, giving respective lengths, general features and cost, with advantages and disadvantages. Further information will be found in the appendices with the reports of Mr. Gregory, the engineer who made the survey ; also, a tabulated statement of the general characteristics of each line, with detailed estimates of cost. The numbering on the map agrees with the numbers used by Mr. Gregory up to Line 4.

Line No. 1 represents the original North Shore Line, *via* "Bout-de-l'Ile." It is 55.44 miles in length, being the shortest to build by 2.63 miles.

Its disadvantages are that, as at present arranged, it has grades of 52.8 feet to the mile, both ways, and 15 curves, with a minimum radius of about a third of a mile. It has also 12,000 feet, near Berthier, overflowed by backwater from the St. Lawrence, more than the interior lines. Much of the grade level, also on the whole of the overflowed district, has been laid 5 feet under high water mark. (See Messrs. Garden and Gauvreau's report in appendix 5.) It has been necessary to raise the embankments to meet this error.

There is also a long and expensive draw-bridge at "Bout-de-l'Ile." These draw-bridges are very dangerous, and should be avoided at any reasonable expenditure.

The cost for works is $1,229,486.00.

Line No. 2 is the Joliette Line, as recommended by Messrs. Bemister and Slater, civil engineers. It diverges from the Shore line at Maskinongé, passing through Joliette, Terrebonne and " St. Vincent de Paul " to Hochelaga. It is 7¼ miles longer than line No. 1. It moreover passes over a summit, near Joliette, a hundred and ten feet higher than the other lines, thus virtually lengthening it, for all practical purposes, several miles more.—Reference is made to Mr. Gregory's report (appendix 2.) His remarks on the effect this line will have " in completely crippling the through Freight Traffic ", I thoroughly endorse.

The estimated cost is $1,457,061, or $227,576 more than Line No. 1.

Line No. 3, is the subject of another special report by Mr. Gregory (appendix 3.) This report was subsequently *withdrawn*, and the supplementary report (appendix 4) substituted.

I do not recommend this line, because it is longer, has steeper grades and sharper curves than the line immediately following, and for other reasons given in appendix 1.

No. 4, diverges from the Shore Line, between Maskinongé and Berthier, passing ¾ of a mile further north of Berthier, and thus better avoiding the *overflowed lands*. It runs, in one continuous straight line, 38 miles to Terrebonne. Between Terrebonne and Hochelaga there are two easy curves of upwards of a mile radius.

With the exception of the "rivière des Prairies" crossing, where the works are heavy, this line is simple and easy to construct, grades no where exceeding 26 feet to the mile, in both directions. It could be worked with extreme speed and economy. Its total length is 58.56 miles, or 3.15 longer than the Shore line ; but, owing to its unusually straight and level nature, and the fact of its encountering no draw-bridge to delay trains, it could be worked with greater safety, speed and economy than the Shore Line.

It has but 4 deep water foundations at " rivière des Prairies," against *twelve* on the Shore Line at "Bout-de-l'Ile." These foundations are the keys of the work and govern the time of completion. Practically, the fewer there are of them, the sooner can the Line be built and interest of money, during the construction, saved : *a serious item not to be overlooked.*

This line has also 1,000 feet less Iron *Truss* bridging than the Shore Line.

Its total cost is $1,140,110, or $89,376 less than the Shore Line, bringing both to the same standard of excellence, as regards grades ; the reduction of which grades on the Shore Line, to equal the direct line, amounts to $44,800 of this difference. (See detailed estimates, appendices 6 and 7.)

If one continuous through line to Montreal is to be built, this is the line I recommend. It should, at any rate, be adopted from Maskinongé to Terrebonne.

No. 5 is an extension of the Main (No. 4) Line to which attention is particularly drawn. It is 11 miles long, running from Terrebonne *viâ* " St.

Vincent de Paul," along the north bank of the river "Des Prairies," to a junction with M. O. & O. Railway, near "Sault-au-Récollet:" the whole very easy to construct.

The adoption of this Line would save building the very expensive portion of the direct line, between Terrebonne and Hochelaga, using in its stead the M. O. & O Railway, between "Sault-au-Récollet" and Hochelaga; thus having *but one line into Montreal, instead of two, to work and maintain.* By this arrangement, all connections necessary to hereafter complete the North Shore system, can be easiest made, and all interests practically served with the least expense and considerable saving in time of completion, but with the draw-back of lengthening the line into Montreal—11 miles more than No. 1.

Its cost will be $230,344.00

The section of the Shore Line, between "Bout-de-l'Ile" and Hochelaga—11.90 miles long,—is estimated to cost $28,047. more than the corresponding section of the direct line, between Terrebonne and Hochelaga. (See estimates in appendices 6 and 7.)

The section of the (No. 4 Line, from Terrebonne to Hochelaga—11.56 miles in length,—is estimated to cost $519,656.00, or $45,000 per mile, for works alone, exclusive of land damage, stations, rolling stock, &c. It may, therefore, be well to consider the effect of suspending this very expensive portion, using in its stead the Line *viâ* "St. Vincent de Paul" and "Sault-au-Récollet" (No. 5,) and the Montreal, Ottawa and Occidental Railway to Hochelaga: thus saving present expense, (see former remarks,) and large sums for interest during the extra time of construction.

Were this Line No. 5 adopted, it could be made for $289,312 less than the direct line from Terrebonne to Hochelaga, as will be seen by the following comparative estimate:—

Cost: from Terrebonne toHochelaga, direct (appendices 6 & 7,)	$519,656
Cost: Line 5, as per Estimate, ...	230,344
Difference in favor of Line 5	$289,812

The distance from Quebec to Hochelaga, *viâ* Line 5, is 170 miles, or about 11 miles *longer* than the Shore line No. 1, and three miles *shorter* than the Grand Trunk. The avoidance of the ferry crossing at Levis, Richmond Junction and Victoria Bridge, would enable the journey to be made in much less time than by the latter line.

The distance to Ottawa, on the other hand, is 6 miles less this way than by Line No. 1.

To show the favorable nature of that section of the direct Line No. 4, from Maskinongé to Terrebonne, it is sufficient to note that its cost, for track and works, is but $13,200 per mile; deducting the value of the track itself—$7,000 per mile—(common to any line,) leaves but $6,200 per mile for all other work. These figures shew how well adapted this section of country is for railway construction, and prove the propriety of laying the Road direct, whereby,—in the highest degree, —speed, safety and future economy will be permanently secured.

Having now laid the facts before you, I leave the matter in your hands. If the preponderance of traffic is expected from Montreal, then the original (No. 1) Shore Line is the shortest. If, on the other hand, it is anticipated that the great and rapidly increasing volume of the North-West trade will be brought to Ottawa by the Canadian Pacific and other railways ultimately to terminate there, it would seem judicious to adopt the direct line No. 4 as far as Terrebonne, leaving the Western extensions—shewn by dotted lines—for further consideration. The dotted Loop North of the Ottawa (No. 6), which could be very cheaply and easily constructed, would permit this prospective North-West trade to be carried direct.

Should the Government build a direct line to Hochelaga, No 4, by Terrebonne, will serve the interest of both Quebec and Montreal, as well as No. 1, by " Bout-de-l'Ile." It costs less and could be opened for traffic sooner than the latter line.

All of which is respectfully submitted by

Your obedient servant,

A. L. LIGHT,

Goverment Engineer,

Eastern-Section.

N.-B.—The appendices above referred to will be found at the end of the book.

Mr. PETERSON'S report on Mr. LIGHT'S survey, estimates and report on the several lines examined between Maskinongé and Hochelaga.

Quebec, 27th Jany., 1877

To Hon. C. B. de Boucherville,
"Premier," &c., &c.,

Sir,

According to your request, I have examined the plan and report and appendices which you handed me on the 23rd inst. referring to the location of that portion of the North Shore Railway, between Maskinongé and Montreal, and now beg to report the conclusions I have arrived at as to the relative merits of the various lines submitted.

I quite agree with the views expressed in the report on the Joliette or No. 2 line, which are that, on account of its greater length, heavier grades and increased cost, it should not be adopted.

No. 3 line, between Maskinongé and Terrebonne, is less direct than No. 4, and has nothing to set off in its favor against this disadvantage. Between Terrebonne and Montreal, No. 3 is about a mile and a half longer than No. 4, and the work, on both lines, is exceedingly heavy. I consider that the directness of No. 4 should give it the preference.

This leaves the choice of routes to be made between No. 1, — the old North Shore line,—and No. 4,—the line recommended by Mr. Light in the report now under consideration.

In this report the disadvantages of No. 1 line are stated as follows: "As at present arranged, it has grades of 52.8 feet per mile, both ways, and fifteen curves with a minimum radius of about one third of a mile. It has 12,000 feet, west of Berthier, overflowed by backwater from the St. Lawrence, more than the interior lines; much of the grade level, also on the whole of the overflowed district, has been laid under high water mark."

"There is also a long and expensive draw-bridge at "Bout de L'Isle." "These draw-bridges are very dangerous, and

Mr. LIGHT'S remarks on Mr. PETERSON'S report.

Quebec, 12th December 1877.

To the Commissioners of the Q. M. O.
& O. Railway.

Gentlemen,

I beg to submit the following remarks upon Mr. Peterson's report regarding the surveys, plans and estimates of the several lines, between Maskinongé and Hochelaga, which were made in the summer of 1876 under my direction. The facts will speak for themselves.

Mr. PETERSON.

should be avoided at any reasonable expense."

"The cost for works is $1,229,486.00."

In considering these disadvantages, I would say that there has been put, in the estimate of No. 1 line, 160,000 cubic yards of earth-work, in order to make the grades 26.4 feet per mile; and, as the cost of this extra earth-work has increased the estimate $44,800, and consequently been made available as an argument against No. 1, it is not, to say the least, quite fair to state that No. 1 has, as at present arranged, grades—both ways,—of 52.8 feet per mile. A reference to the table of grades, attached to Mr. Light's report, (appendix No. 6,) will, I think, shew that No. 1 has easier grades than No. 4. No. 1 has 27.69 miles level, whereas No. 4 has only 27.40 miles. Of grades of 10 ft. per mile, and under, No. 1 has 13.73 miles, and No. 4—14.75 miles. Of grades from 10 to 20 ft. per mile, No. 1 has $5\frac{68}{100}$ miles, and No. 4—has $6\frac{59}{100}$ miles. Of grades of from 20 to 30 feet per mile, No. 1 has $5\frac{43}{100}$ miles, whereas No 4 has $9\frac{85}{100}$ miles. Of grades of 30 to 40 feet per mile, No. 1 has $1\frac{50}{100}$ mile, No. 4—nothing. Of grades of 40 to 52.80 per mile, No. 1 has 1.68 miles, No. 4—nothing. From these facts, it will be seen that No. 1 has the advantage in grades over the whole line, except on the $1\frac{50}{100}$ mile, where the grade is from 30 to 40 feet per mile, and $1\frac{68}{100}$ mile where the grade is between 40 and 52.8 feet per mile. But, when you remember that 160,000 yds. of earth-work are included in the estimate, to do away with these grades over a distance of $3\frac{18}{100}$ miles, it must be admitted that the advantage is decidedly in favor of No. 1.

The second objection made to No. 1, is that: "it has 12,000 ft., west of Berthier, overflowed by backwater from the St. Lawrence, more than the interior lines."

The corrected profiles shew that No. 1 has no portion of it, west of Berthier, overflowed by high water, but, admitting that there are 12,000 feet more of No. 1 overflowed, east of Berthier, than upon the interior lines, this cannot be used as an argument against it, in as much as the estimate for No. 1 contains an extra amount of earth-work over the 15,000 ft., between the "Chicot" river and the road leading from Berthier to Joliette, of

Mr. LIGHT.

It is an established fact that the maximum grade of a line governs its traffic, and, as the original maximum grade of the Shore line (No. 1) is 52.8 ft. per mile, while that of line 4 does not exceed 26.4 ft. per mile, or half the inclination, the superiority of No. 4 over No. 1 must be conceded. Had line No. 1 been adopted, the reduction of grades—alluded to—would have become desirable and would have rendered both lines equal. Admitting the cost of said reduction to be $44,800, there would be still, according to my estimate, a balance of upwards of $44,000 in favor of line No. 4, not to mention the superior advantages this line presents in direction, straightness, saving of flooded lands and avoidance of drawbridge.

FLOODED LANDS.

A clerical error in my report where the words "West of Berthier" should read *east* of Berthier, is here made use of. †

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† Since the adoption and location of line 4, the saving in flooded lands, as above stated to be 12,000 feet, has been found to amount actually to 31,000 feet, or about 6 miles of submerged line placed beyond the reach of the flood.

Mr. PETERSON.

51,560 cubic yards, and also 24,343 cubic yards of rip-rap, which adds $63,122 to the estimate. It is to be presumed that, with this additional expenditure, this portion of the line is as good as many other parts of it, and, as it tells against the line in the estimate to the extent of $63,122, it should not be made to do duty again.

I am of the opinion that $48,686 of this amount, put in for rip-rap, will not be required, and that sodding will be ample protection.

No provision for rip-rap, for the overflowed lands on the other lines, appears in any of the estimates — original or those attached to the report now under consideration,—for the land overflowed to the east-ward of the "Chicot" river, but it may be maintained by Mr. Light that this has been left out, being common to Lines Nos. 1 & 2, and would increase all the estimates to the same extent.

The third argument that: "much of the grade and, also on the whole of the overflowed district, has been laid under high water mark," has nothing in it, in as much as both lines are equally overflowed from Maskinongé to Station 1740, and from 1740 to 1890, as mentioned above. 51560 cubic yards of earth have been put additional on No. 1, in order to keep it out of water.

The next objection urged by Mr. Light against No. 1, is the draw-bridge at "Bout-de-L'Isle;" he says: "These draw-" bridges are very dangerous and should " be avoided at any reasonable expense."

Every person must consider a draw-bridge a source of possible danger to be avoided at any reasonable sacrifice of money or directness of line. Still, at the same time, it should be remembered that, with the care and foresight that should be observed over all parts of a railway, a draw-bridge may be rendered as safe as any other portion of the line. Let the rule be enforced that no train be allowed

Mr. LIGHT.

RIP-RAP.

I have no doubt as to the propriety of rip-rapping the submerged parts of the embankment. The water will often stand 9 feet deep on a level, and, as the line is exposed to the full sweep of Lake St. Peter, there will at times be considerable wash against the bank. Both stone facing *on* the slopes, and stone ballast *under* the track, will be needed to make the work permanent.

This conclusion is correct. Not wishing to encumber the estimates with unnecessary items, I charged merely the excess of rip-rap on line No. 1. The same course was pursued with regard to land damages, fencing, stations, rolling stock and any other items common to both lines.

DRAW-BRIDGE AT "BOUT DE L'ISLE.'

My opinion, as to the danger of draw-bridges, is shared by all experienced engineers. It is indeed not so much a matter of opinion, as a matter of fact. There is hardly a draw-bridge on this continent, that has not been the scene of positive disaster, despite the most stringent legislation. Had the line, *viâ* "Bout de l'Isle", been adopted, the grade at that point ought certainly to have been raised to admit of vessels passing under the bridge, thus dispensing with the draw. The change, however, would have rendered this line far more expensive than line No. 4, without any corresponding advantage.

Mr. PETERSON.

to cross the bridge, without first coming to a stand and receiving a signal that: "all is right," and then the danger is nearly, if not altogether avoided. There will, in all probability, be a station near the Bridge on the east side, and perhaps also on the west; so, no time need be lost, beyond that necessary, to take on or let off passengers. I shall refer to this question again as well as the cost of this route, when discussing line No. 4.

Having thus gone over the objections to the North Shore or No. 1 Line, I will examine the arguments adduced in favor of No. 4 Line.

The first point mentioned in its favor is: "That it passes ¾ of a mile further north of Berthier, and thus better avoiding the overflowed lands." This question has been hereinabove fully discussed in this report, where it is shown that, as the extra cost of passing over this ground, has been put in the estimate and has there its full force in increasing the cost of line No. 1, and strengthening the case for No. 4, it has no right to be brought in again as an argument against the Shore line.

The second point mentioned in favor of No. 4 is that: "it runs in one continuous straight line for 38 miles, and has only two easy curves of upwards of a mile radius."

It is, of course, an advantage for a line to run as straight as possible, and to have the easiest curves that can be obtained. No. 1, it is stated: "has 15 curves with a minimum radius of about one-third of a mile." I have no means of obtaining the radius of each of the other curves, but the plan of the survey shews but one of the curves of the radius mentioned, all the remainder being much larger, and the nature of the country will admit of their being flattened to almost any extent. There need be no curves on this line, except possibly those at the "Bout-de-l'Ile," which should prevent as quick time being made over No. 1, as over No. 4. But, of course, there is always a little more wear on rails and the flanges of the wheels on a curve, than there is on a straight line; but this is held by some to be amply compensated for by the effect curves, of moderate radius, have in counteracting

Mr. LIGHT.

STRAIGHT LINES.

It is positively absurd to deny that straight lines are best and safest, apart altogether from the question of increased speed and durability. The fact of being able to see a long distance ahead, almost precludes the possibility of collisions, which are of only too common occurrence on crooked lines. At Bennett's crossing, near Levis, on the Grand Trunk, four fatal accidents have occurred, within 10 years, due to curves in the alignment. The talk about "oscillation" on a "straight line," is sheer non-sense.

Mr. PETERSON.	Mr. LIGHT.
the oscillations which a train acquires in passing rapidly over a long straight line. There are 182° degrees of curvature on No. 1, and 86° degrees on No 4. This shews that, although No. 4 has but two curves, and No. 1 has 15, the curvature on No. 4 is but a little less than one-half of what it is on No. 1. So, it will be seen that, instead of the curvature on No. 1, being to that on No. 4 as 15 to 2, as the report would seem to imply, it is only in the proportion of 2 to 1.	ANGULAR DEFLECTIONS. Although each of the 15 curves on No. 1, has a smaller angular deflection than the two curves on No. 4, yet, the changes in direction, caused by the former, are sufficient to entirely block the view in passing from one straight line to another; so that the danger from collisions, remains the same.
The next point mentioned in favor of No. 4, is that: "with the exception of the "Des Prairies" crossing, this line is simple and easy to construct (grades no where exceding 26 feet to the mile, in both directions,) it could be worked with extreme speed and economy."	This question of gradients has been already discussed.
The "Des Prairies" bridge will be discussed further on, and I will simply say that, placing the "Des Prairies" and "Des Mille Isles" bridges, and their approaches against the "Bout de l'Isle" bridge, that of the remaining work on the two lines, that on No 1 is simpler and easier than No. 4. No. 4 certainly passes through three miles of the "Grande Savane," and probably it may be much more, when the line of No. 4 is run through, whereas No. 1 only runs through 4,500 feet of it. It would seem, from an inspection of the original plan, that the curves were put in No. 1 for the purpose of avoiding the difficulties likely to be encountered in constructing the line through this soft marshy ground. As before mentioned, the grades are easier on No. 1 than on No. 4.	I also discuss this matter further on. CURVES AT "GRANDE SAVANE." The curves in question were wholly unnecessary. The "Grande Savane" has been drained and graded, and construction has proved even easier than I anticipated. The track is laid and partially ballasted, and heavy construction trains are hourly running over it, without any settlement taking place. The adoption of this line has reduced land damages to a minimun for a distance of 18 miles, while the drainage of the swamp brings into cultivation several thousand acres of excellent land hitherto valueless and lost to the country.

MR. PETERSON.

With reference to working No. 4 with extreme speed and economy, it may be stated No. 4 has 25570 ft. of cuttings or about five miles of cuttings, whereas No. 1 has only 3214 feet of cuttings, about 6/10 of one mile, or about one-eight of the amount that there is on No. 4, (see further on in this report for details of these cuttings.) No. 4 has three or four cuttings, between Terrebonne and Montreal, that will seriously effect the working of the line ; one is near Terrebonne, over 1000 feet long and about five feet deep ; one on "Isle Jésus," 1200 feet in length of rock, 16 feet deep for 200 feet, and averaging seven feet over the remainder ; and another on the Island of Montreal, 1100 feet long, 700 ft. of which is 10 ft. deep, and from the shape and position of the cut, I presume it is rock, being no doubt a portion of the ridge that is met with, in crossing the Island on the Line of the Montreal, Ottawa and Occidental Railway. It is more than probable that snow sheds would have to be built through these cuts, in order to work the line during the winter. No. 4 has 32 cuts over 200 feet in length. Of these 32, 13 are over 750 feet long, and of these 13, 7 are over 1000 feet in length, and, amongst the 7, one is found which is 3450 feet long with greatest depth of five feet and average depth of 3 feet. No. 1, as an inspection of the profile will shew, has only two cuts on the whole line, over 300 feet long; one of these, which is 3 feet in the deepest place, is 300 feet long and averages 2 feet cut throughout ; another, 350 feet long, has a greatest depth of 9 feet, with an average depth of 6 feet. The remaining cut is five hundred and fifty feet long, the greatest depth is 8 feet, averaging throughout 5 feet. These two last are on the edge of the "Grande Savane," and will be a positive advantage in the construction of the line, if the method proposed by Mr. Light, for making the Road through the "Savane," be adopted, as the sand required to make the road bed over the soft ground, can be taken from these cuts at a cheaper rate than can be obtained at any other place The quantity required will make these cuts about 80 feet wide, and with ditches put through them—as shown in the annexed sketch,—

MR. LIGHT.

CUTTINGS.

Line No. 4 has in fact only 6000 ft. or less than a mile and a quarter more cutting than No. 1, on a whole distance of 58 miles between Maskinongé and Hochelaga: amounting to less than two per cent.

MR. PETERSON.

the Road will pass through the cuts almost as easily, as regards running the trains, as if they did not exist.

The rock cuts on No. 4 cannot be treated in this manner, and it is, of course, expensive to treat cuts in this manner, when the material is not required to make an adjoining embankment.

Again—as already stated—the average embankment of No. 1, over level ground, is $3\frac{1}{2}$ feet, whereas No. 4, if all embankment, would only be raised 2 feet.

The experience gained from the difficulties encountered in working Railways, during the winter months in this climate, through deep or even shallow narrow cuttings, or over embankments laid too low, should teach not only all Canadian Engineers, but every observing person who may have travelled during the winter months over any of our railways, that there can be no comparison between a road bed raised,—such as the profiles of No. 1 shew—as against that of No. 4,—with its long cuts and low embankments. And, therefore, it cannot be maintained that: "No. 4 can be worked with greater speed and economy than No. 1."

The next paragraph states that: "Though No. 4 is 3 $\frac{15}{100}$ miles longer than the North Shore, but, owing to its unusually straight and level nature, and the fact of its encountering no draw-bridge to delay trains, it could be worked with greater safety, speed and economy than the North Shore."

The draw-bridge might probably cause as much delay as would be required to run this extra 3 $\frac{15}{100}$ miles, but I am inclined to think that the only delay that would arise, would be in stopping to see that the bridge was all secure, and, as already mentioned, this delay would probably be at a station; so, no time would really be lost. It must also be remembered that there would be but little traffic through the draw, and none at all, for at least six months in the year, when, of course, a draw bridge is as secure as any other structure.

All the other points mentioned in the above extract, as to the unusually level and

MR. LIGHT.

ROCK CUTTINGS.

There is only one rock cut on line No. 4, which contains 6290 cubic yards. It has not yet been touched as it is *west* of Terrebonne, but there is no reason why it should not be widened to any extent. Large quantities of rip-rap will be needed for the work, which can be brought with greater convenience from this point.

LOW EMBANKMENTS.

It is somewhat strange that, holding these views Mr. Peterson should have neglected to raise the grades on the N. C. Railway, as I so strongly advocated in my report on that Road, of 20th January 1875.

LOSS OF TIME CAUSED BY DRAW-BRIDGE.

It is admitted that the draw-bridge might cause as much delay as would run the additional 3 $\frac{15}{100}$ miles, but Mr. Peterson is "inclined to think the only delay would be in stopping to see the bridge was all secure, &c."

This is a self evident error. The time consumed in passing the draw, would far *exceed* that required to run the extra three miles of straight and level line, not to touch upon the vital question of danger to life and property.

Mr. PETERSON.

straight nature of No. 4, have been discussed above. As to economy, it must be remembered that there will be, between Quebec and Montreal, $3\frac{15}{100}$ mile more rails, sleepers, fence, &c., to maintain, and the extra wear and tear of rolling stock, caused by this extra mileage, and also the expense for working through the long cuts on this line, which do not exist on No. 1. So, you will perceive that it cannot be maintained that: "Line No. 4 can be worked with greater safety, speed and economy than the North Shore Line."

The next paragraph in the report states that: "No. 4 has but four deep water foundations at "rivière des Prairies," against 12 on the North Shore at "Bout de l'Ile." These foundations are the keys of the work and govern the time of completion. "Practically, the fewer there are of them, the sooner the line can be built."

"This line has also 1000 ft. less Iron Truss bridging than the North Shore Line."

The "Des Prairies" river, as shown on the profile, will have five spans with foundations below summer water level, at the following depth: No. 1—6½ feet, No. 2—11 feet, No. 3—15 feet, No. 4—11½ feet, No. 5 11 feet. The "Bout de l'Isle" foundations are as follows: east abutments on dry land, No. 1 Pier below low water – 3 feet, No. 2—10 feet, No. 3—13½, No. 4—21 feet, No. 5 - 24 feet, No. 6—23 feet, No. 7 - 22 feet, No. 8—19 feet, No. 9 - 6 feet, No. 10 - 3 feet, west abutment on dry land. Following the plan adopted at "Des Prairies," of only calling foundations in more than 10 feet of water: "deep water foundations," it will be seen that there are only seven deep water foundations on No. 1, instead of 12, and nothing exceeding 24 feet, at which depth there has been no difficulty in putting down foundations at the Gatineau river, during the past season. No borings have been taken at "Des Prairies" river, but, in the appendix No. 3, the Engineer who conducted the surveys, speaks of this crossing and foundation as follows:

"The direct line, between Terrebonne and Hochelaga, can hardly be entertained, on account of the width of the river

Mr. LIGHT.

DES PRAIRIES RIVER BRIDGE.

It is here imagined that five spans were contemplated for the "Rivière des Prairies" Bridge, although the estimate attached to my report shews but three, giving four foundations, in an average depth of 15 feet. On the *contract* plan of the "Bout de l'Isle" Bridge, left in the office by my predecessors, there were 13 piers, exclusive of the two draw-rest piers, and two abutments; making 17 foundations in all. Of these the two abutments and one pier only, were on dry land, at extreme low water. The rest were in water from 3 to 20 feet in depth. The number of piers could, of course, be reduced, but the cost of the iron superstructure per lineal foot, would thus be very largely increased. I have no doubt that the foundations are the keys of the work, the rest can be finished far in advance.

DES PRAIRIES RIVER CROSSING.

That portion of Mr. Gregory's report is seized on which refers to the

Mr. PETERSON.	Mr. LIGHT.
crossing which is 2700 feet. * The intervening island being swampy, would not diminish the cost of bridging. The approaches and bed of the river are also soft ground." Borings have been taken at "Bout-de-l'Ile," and I am informed by Mr. Chandler, the Engineer who personally superintended them, that it was with great difficulty that a 2 inch gas pipe, with a screw end, could be got 6 feet into the blue clay, and, that beyond this depth, it was impossible to force it down. The current, he informs me, was not swift enough to bend this pipe, and that no trouble was found in dropping it into any position. From this I infer that piles can be driven without any outer coffer dam, and that the caissons can be put down with very little difficulty or expense.	crossing of the "Rivière des Prairies." A sufficient reply to this objection, is Mr. Gregory's subsequent withdrawal of his first report and substitution of that given in appendix 4. Mr. Gregory became convinced that no more waterway was required here than at the crossing of N. C. R., a short distance above. The fact of the intervening Island being sand, will undoubtedly diminish the quantity of earth required to form the embankment at this place. Mr. Gregory informed me that he used the term "soft" in contradistinction to the *rock* bottom at "St. Vincent de Paul" and Terrebonne, and that the respective river-beds at "Rivière des Prairies" and "Bout-de-l'Isle" were of clay which makes a good foundation, if properly treated. The borings referred to are utterly valueless, having been made on Mr. Peterson's showing by "a 2 inch gas pipe with a screw end."—Comment is hardly needed. I can only say that the results of borings taken by such an implement, would not be accepted by an engineer of any experience.
When it is stated in the report that: "this line (referring to No. 4,) has over 1000 feet less iron truss bridging than the North Shore line," one would naturally think that No. 4 had 1000 feet less iron bridging than No. 1, but such is not the case. It seems that a distinction has been drawn between iron bridges with stone piers and iron superstructure, and those with iron piers and iron superstructure, and that the former, for some reason or other, have not been mentioned in the report. Though, if iron bridges with stone piers are objectionable, iron bridges, with iron piers, are much more so, as iron is more perishable than good building stone, and requires much more care and has to be painted every two or three years. The quantity of iron brid-	IRON TRUSS BRIDGING. Line No. 4 has 953 feet less iron truss bridging than line No. 1. The original contract for the truss bridging at "Bout-de-l'Isle", was 2340 feet, while the truss bridging on line No. 4—is 1387 feet, making the difference above stated. Mr. Peterson has confounded 2300 feet of iron *trestle work*, on line No. 4, with *iron truss bridging*. The trestle work is estimated at $30 per lineal foot, *inclusive* of masonry and foundations. The truss bridging is charged at $85 per lineal foot, *exclusive* of masonry and foundations. They are entirely different descriptions of work, and cannot be classed in the same category.

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* **From bank to bank this crossing is, at high water mark, 3600 feet, and from top of bank to top of bank, 4700 feet.**

MR. PETERSON.

ging on No. 1, as stated in the estimate, is 2340 feet, and on No. 4—1387 on stone piers, and 2300 on iron piers or trestles, placed on the top of an earth embankment; making a total for No. 4 of 3687 feet. Thus, it appears No. 4 has 1347 feet of iron bridging more than No. 1. No. 1 has but 750 feet of wooden bridging, whereas No. 4 has 1000 feet. So, taking wood and iron together, No. 4 has 1597 feet more bridging than No. 1. By reducing the water-way at "Bout-de-L'Isle" to what it has been fixed at on No. 4 for the rivers "Des Milles Isles" and "Des Prairies," and adding 100 feet for the additional water that comes in from the "Masconche," we get the bridging on No. 1 reduced to 1487, or say: 1500 feet. The water-way, at low water, is about 2080 feet, and, in order to place the abutments on dry land on each side, we should only require 2140 feet of iron bridging, which I consider ample dimensions for the Bridge at this point.

I consider the plan proposed for crossing the "Des Prairies" River, to be very dangerous; the natural water way, at high flood, is 3600 feet. And it is proposed to confine this within 750 feet, and to fill up the remainder with earth-work to the level of high water, and on this earthwork, in the water, exposed to the action of the current and ice, to build low stone foundations on which to set up the iron piers for 2300 feet of bridge. This earth will take a long time to consolidate, and, of course, whilst the settlement is going on, the stone foundations unless built on piles or carried for more than 20 feet through the embankment, to hard bottom, will also settle and endanger the stability of the whole structure. Nothing has been put in the estimate of the bridge for these expensive foundations.

If Line No. 4 be adopted, I would not consider it safe to carry out the plan proposed at this river. I think the "Bout-de-l'Isle" bridge, with the disavantage of its draw, much preferable.

MR. LIGHT.

WIDTH OF "DES PRAIRIES" CROSSING.

It is true that the width of this crossing, at high water, is 3600 feet; this includes the 1250 ft. of the intervening island. The entire water, however, passes easily through a space of 500 feet at the N. C Ry. bridge, a short distance above. There are no intervening streams and it is considered that the contemplated width of 750 feet in the clear, as arranged for this crossing, is ample and perfectly safe; the more especially as rock is almost certain to be found a few feet under the bottom. It crops out at "St. Vincent de Paul" (just above) and at Rock Island immediately below.

The additional width at high water converts the river into a mere lake, with a current of about half a mile an hour. This current runs at an elevation of about five feet below extreme high water mark. When the water attains the extreme height, it is the "Digue" or back water from the St. Lawrence, and then there is no current, and, consequently, no pressure from ice.

If properly rip-rapped, there is no reason why the embankment here should not stand quite as well as the 2000 ft. of embankment at the Victoria Bridge,

MR. PETERSON.

The cost of No. 1 is put down at $1,229,486, and of No. 4 at $1,140,110, and, as stated in the report: "is $89,376 less than the North Shore line, bringing both to the same standard of excellence as regards grades; the reduction of which grades on North Shore, to equal direct line, amounts to $48000 of this difference."

I can say nothing very definite as to the relative cost of the two routes, as I do not consider the estimates you have handed me, to be reliable; they bear every evidence of having been carelessly made, and I regret I am compelled to come to the conclusion that they and the report have been prepared with a view of magnifying the difficulties on No. 1, and depreciating or entirely ignoring those on No. 4.

I may state the following as some of

MR. LIGHT.

which has safely withstood, for twenty years, the tremendous pressure of large masses of ice, driven by a current running 7 miles an hour.

The foundations which are here considered so unstable, are perfectly safe; they were all provided for in the estimate. which was stated in gross at $30. per foot. The estimate for the trestle work itself was $24 per foot complete. Prices for this work were obtained from three of the best bridge builders in the United-States.

The foundations in the water were designed to be heavy cast iron screw piles buried in earth embankment properly rip-rapped to 3 feet above extreme high water level, and on the island piers of masonry. The average price of the foundations was $6. per foot; this added to the cost of the trestle work, made up the $30 per lineal foot charged in the estimate.

CORRECTNESS OF SURVEYS.

These strictures are wholly unwarranted, and are contradicted by the facts. The Surveys were carefully made under a thoroughly experienced engineer, with a competent staff of assistants, and were very comprehensive; every possible line and connection having been explored to the number of 4 through lines between Maskinongé and Hochelaga, as may be seen by an examination of the accompanying map. It is to be regretted that important private business compelled Mr. Gregory (the chief of the parties,) to leave before the estimates were completed, and his assistants were thereby placed under great disadvantage. The estimates have been made by these gentlemen; I merely instructed them to apply the same system of measurements, prices, &c., to all the lines without distinction. These assistant engineers were intelligent and experienced; —three of the number have held for years responsible positions on the I. C. Ry., during surveys and construction.

It appears that a clerical error oc-

MR. PETERSON.

my reasons for having arrived at this conclusion:—The lines Nos. 1 and 4 start from a common point, station 1214, and from this point to 1740; the same profile has been taken for each; and yet No. 4 shews 249,715 yards over this distance, while No. 1 shews 158,890 yards. On enquiring with reference to this, I have been informed by one of the Engineers who made the Survey, that an error exists here to the extent of 90,825 yards, and that each line should be 158,890 yards. Then, from station 1740 to 1890, No. 1 is put down at 82,570 yards,* and No. 4 at 31,011. No. 1 is on the located line checked by the Engineers who made the survey last summer; No. 4 is on an imaginary line.

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* This quantity, on examination with one of the Engineers engaged making the surveys and taking out the quantities, is found to be 15,000 too much.

MR. LIGHT.

cured in estimating the quantities of earth-work on line No. 4, which only shews that such accidents will sometimes happen with the most careful professional men. The error was not discovered by Mr. Peterson, but pointed out by Mr. Garden, the engineer deputed to explain the estimate to him; this shews that there was no attempt at concealment. The error, moreover, was in *excess* and, therefore, *against* the line I am accused of favouring.

Another supposed error in the quantities on line No. 1, has, on careful remeasurement, been found not to exist. It will be seen that the errors—here alluded to—are in earth-works only—an insignificant item on these lines, at the most; such trifles should not, for a moment, be allowed to weigh in deciding this most important question of location.

I refer to the figures of Messieurs Lindsay and Temple who have since carefully checked the quantities of earth on Lines 1 and 4, also to the figures of Messrs. Boyd and Hoare who checked the masonry on both lines. These checks have been made without any reference to the work previously done by their predecessors. The following results shew that the first calculations were substantially correct:—

Line 1. (Earth work).

Lindsay & Temple original grades	791 244
To reduce to 26.4 per mile......	160.827
	952.071
Quantities in report................	825.550
To reduce to 26.4 per mile......	160.000
	985.550

The latter quantities were taken from a list of sectional quantities left in the office by my predecessors, presumed to be correct. The check was made by scaling the heights of a tracing.

Line 4. (raised grades).

Lindsay & Temple (check)...	1.144.892
Quantities in revised estimate.	1.189.800

Mr. PETERSON.

"No 4 is on an imaginary line."

Mr. LIGHT.

Line 4. (Low grades).

Lindsay & Temple (not yet checked).[*]
Quantities in report.......... 962.250

MASONRY.

Line No. 1.

Boyd & Hoare's (check)........... 10.906
In report.............................. 10.821

Line 4. (low grades).

Boyd & Hoare's (check)........... 12.586
In report.............................. 12.502

Line 4. (raised grades).

Boyd & Hoare's (check)........... 12.740

Both lines were generally served alike as to depths of masonry and forms of structure.

With regard to "No. 4 being on an imaginary line," I would state that *two* lines, in its immediate neighbourhood and on each side of it, have been carefully surveyed from Maskinongé to Terrebonne, and 3 from Terrebonne to Hochelaga.

From Maskinongé to 5 miles east of Berthier—about 9 miles,—all the lines are nearly identical. From Berthier to Terrebonne the country is generally so flat that any number of contiguous and parallel lines might be run with nearly the same result. A few minor inequalities exist near the "Chaloupe" River, at the ridge east of "L'Assomption" River, and through the "Savane;" pains have been taken to avoid these. There is no part of Line 4 that cannot be seen from either of the surveyed lines, with the exception of the heavily wooded part of the "Grande Savane," where the country is practically level. It is most unlikely that any unexpected obstacle could arise in so open and level a district.

All the important rivers, it will be

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[*] These quantities could not be checked as Mr. Peterson borrowed the profile, and has failed to return it.

MR. PETERSON.

Between 1819 and "Bout-de-l'Isle," the distance on No. 1 is 30.7 miles, and the quantity returned on this distance (less its proportion of the 160,000 yds., added to lower the grades,) is 389,670 c. yards or 12,690 yards per mile. Between the same points—station 1890 and the "Terrebonne" bridge—the distance is 34 miles, and the quantities returned 239,745 cub. yards, or 7051 yards per mile. Yet, over these two lines, the profiles show that Line No. 1 runs over a much more level, smoother, and, in every way, easier country than No. 4.

MR. LIGHT.

seen are crossed directly on one or other of the actual lines of survey, viz: the River "Des Prairies," "Des Milles Isles," "Mascouche," "L'Assomption" and "Bayonne." The four remaining streams, "L'Achigan," "St. Esprit," "Chaloupe" and "Chicot" are insignificant and they, as well as the outlines of the "Grande Savane" have been so carefully traversed and mapped out, that the line through the latter, as well as the sites of these small bridges, are almost as well defined as though the line had been continuously run. The profile was carefully arranged by Mr. Gregory. He used the profile of the base line and that of the Blue or No. 3 Line, which covered similar ground and made slight changes, when necessary, at the "Savane" and other places.

This process is a method in common use in the profession, to save expense on preliminary work.

So much confidence had the engineer in charge of survey in this arrangement, that, when I proposed to him to run the line over again, he considered it a waste of time, until it was known whether the line would be adopted, as the approximate profile was sufficiently correct for all purposes of comparison.

INSUFFICIENT QUANTITIES ON NO. 4.

The final location of line No. 4, proves the working *profiles* to be *better* than the approximate ones compiled from the original lines.

Mr. PETERSON.

I cannot see how any one wishing to make a fair comparison of the two routes, could use such quantities as those above mentioned. The quantities put down to No. 1, would build a bank nearly three and a half feet high over its entire length, from 1890 to "Bout de-l'Isle," and the quantities of No. 4 would only build a bank over the same portion, which is 3 7/10 miles shorter than that part of No. 4 referred to, (which is between 1890 and Terrebonne,) of 2.2 in feet; and, if it could be laid over the entire surface of No. 4, it would only give a bank of 2 feet in height; and, as No. 4 is very much more uneven than No. 1, of course, this elevation is, consequently, very much reduced, being in many places not even a foot above the surface of the ground.

If only the same quantity of earth-work per mile, were put upon No. 1, that there is on No. 4, between station 1890 and Terrebonne, viz: 7051 c. yds, it would make No. 1 far superior to what No. 4 now is, and the earth-work in No. 1 would be reduced by a 157,767 yards; and, if the same reduction were made over the remaining portion of the Line to Montreal, the earth-work would be reduced to the extent of 214,296 cubic yards.

In addition to this much greater elevation of grades on No. 1, I find that 160,000 yards have been added to reduce the inclination of the gradients, when, in many places, this could be done by making cuttings not nearly as long or as deep as those that are shown upon No. 4. So, I think, 100,000 yds could be gained from this source, making the saving, in earth-work, on No. 1, amount to 314,296 cubic yards.

There are two small rock cuts on No. 1, each 150 feet long, averaging 2 feet in depth, and containing 403 yds.; this quantity is put down in No. 1 estimate. There is on No. 4 a rock cut on "Isle Jésus," which is 1200 feet long and 16 feet deep for 200 feet of its length, and averaging 7 feet in depth for the remainder, containing over 9000 yards; and there is probably another on the Island of Montreal, containing nearly the same amount; and yet no mention of rock is made in the estimate of No. 4.

Mr. LIGHT.

NO. 1 NOT OVERESTIMATED.

So far from overestimating No. 1 (The old North Shore) line, it is very questionable whether enough has been charged to it. On the portion of this line, between Maskinongé and Berthier—the only part where the original levels were checked,—they were found erroneous over the whole distance, the surface being shewn to undulate from 9 feet below to 4 feet above the true level, while the grades were laid 5 feet below the flood level. Only sufficient earth-work (amounting to 77000 c. yards net,) was added to get the embankments above water.

The whole distance to Hochelaga was surveyed by the same engineer, and it is very probable that the same erroneous system of levels, has been continued, and that similar additions will be required throughout. No such additions have been made.

I am confident, from a careful examination of the ground, in addition to information obtained from the most intelligent inhabitants, that the grades at "Bout de L'Isle" are likewise laid far too low to withstand the floods, also that a bridge, built on the levels shewn on the contract profile, will not withstand the ice; yet no addition was made here, or elsewhere, except as stated.

160,000 c. yds. have been added to the estimate of No. 1 to reduce the inclination of the grades. Mr. Peterson "thinks" that 100,000 c. yards of this might be saved by making cuttings, &c.: in fact, recommending work to be done on one line which he condemns on the other. I judged it better to keep the grades above the ground, and the quantity given in my report is strictly correct.

No rock was charged in the estimate of No. 4 line, as its existence was very uncertain. Between Maskinongé and Terrebonne—a distance of 47 miles,—where the work is approaching completion, *there is none*.

MR. PETERSON.	MR. LIGHT.
The masonry in one abutment at the "Des Prairies" river, has only been calculated from the surface of the ground to grade level, although the bottom of the river has been reported soft by the Engineer who made the survey. (See appendix No. 3 in the Report of Mr. Light.) It is calculated for a height of 60 feet, and the quantities put down at 852 yards. The two abutments of the "Bout-de-l'Isle" bridge measure, from grade level to the surface of the ground, 19 and 24 feet each: a total height of 43 feet; and yet they are put down as containing 1510 yds. or 652 yds. more masonry, though, when taken together, they are lower by 17 feet.	The masonry in the Estimate for the "Des Prairies" Bridge, was taken out full enough to cover all contingencies, and fuller than a remeasurement has since shown to be necessary. The difference in quantity between the abutments at "Bout-de-l'Isle" and those at "Des Prairies," was caused by the former having been taken out on the contract plan, while the "Des Prairies" Bridge was designed with tower abutments, as best suited for the locality.
	THICKNESS OF "DES PRAIRIES" BRIDGE AND FOUNDATIONS OF IRON TRESTLES.
Again, the tall piers of the "Des Prairies" bridge have a thickness of 10 feet, while the "Bout-de-l'Isle," with half the height, are made 11 feet. The masonry foundations for the iron piers at the "Des Prairies" river, even supposing they were only carried down 6 feet into the made ground, would give about 2500 yards of masonry; and yet this item does not appear in the estimate.	The piers of the "Des Prairies" Bridge were calculated with the width of 9 ft. on top, or the same as those which have been designed for the "St. Maurice" Bridge, of nearly the same height and span. See drawing of do.) The piers at "Bout-de l'Isle" were taken at 7 feet on top: the width adopted throughout the line for similar spans. The actual quantity of masonry required for the iron trestle piers at "Des Prairies" River, instead of being 2500 c. yards, as stated by Mr. Peterson, actually amounts to only 300 yards; which is shown by the drawing shown by Mr. Fleming; the cost, as already stated, is covered by the price per lineal foot of trestle bridge charged in the Estimate. I referred the question of the clear height, between extreme high water and the lower chords of the bridges, to the Head of the Department of Public Works, in Ottawa, who decided that, if draw-bridges are dispensed with, the clear height of the "Ste. Anne's," bridge over the Ottawa, west of Montreal, on the Grand Trunk Railway, shall be the standard to govern the height of whichever bridge is adopted. This height is 36 feet above extreme high water.

Mr. PETERSON.

With these glaring discrepancies and omissions staring me in the face, you will not be surprised that I do not place any reliance on the estimate you have submitted to me. I think, from the examinations I have made of them, that, instead of No. 4 costing $89,376 less than the North Shore Line, that it will costs over $100,000 more.

The advantages and disadvantages of the various lines, considered as simply connecting Quebec and Montreal, have now been, I think, fully considered, and it is evident that, even with the objection of the draw-bridge at "Bout-de-l'Isle," against No. 1, it must be considered preferable to No. 4.

In considering the various lines under discussion, as parts of the through line between Quebec and the west, *viâ* Ottawa, the choice, as before, remains between No. 1 and No. 4. The only changes in the relative merits of the two, are that No. 4 now becomes the shorter line by 1.78 mile, and that it avoids the objectionable crossing at the "Rivière des Prairies" and the long rock cuts on the route between Montreal and Terrebonne. No. 1 also avoids the draw-bridge at "Bout-de-l'Isle." No. 4 has 470 feet of wooden bridging and 2524 cubic yards of 1st Class Masonry more than No. 1, and has also the same

Mr. LIGHT.

I am strongly of opinion that, had line No. 1 been adopted, the grades should have been raised at "Bout de l'Isle" to this height, so as to do away with the draw-bridge. The difference in cost would then stand thus:—

Cost of Line	No. 1,	$1.337,374
" "	No. 4,	1,237.246
	leaving	100.028

in favor of Line No. 4, via Terrebonne, *exclusive of land damage.* The land, between Maskinongé and Hochelaga, viâ "Bout de l'Isle", is far more valuable than that on line 4 via Terrebonne, between the same points. When this difference in value is considered, this balance in favor of line 4 would certainly be increased one hundred per cent. Mr. Peterson "thinks," from the cursory examination he has made, that line 4 will cost $100.000 more than line 1. It has been ascertained, from careful surveys and estimates, that line 4, with raised grades between Maskinongé and Terrebonne, and the grades reduced to 26.4 per mile at "Des Prairies," would cost—exclusive of land damage,—as above or $100.028 less than No. 1, high level bridges being adopted at River "Des Prairies" and "Bout de l'Isle"; both bridges being 36 ft. above high water, as required by the Department of Public Works.

I differ entirely from Mr. Peterson and hold that the draw-bridge is so objectionable, that it should be avoided at any reasonable increase of cost.

Mr. PETERSON.	Mr. LIGHT.
disadvantages of long cuts, low bank, &c., that have been referred to above. So, I think that, if these disadvantages do not outweigh the advantage that No. 4 has over No. 1 in length, it at least leaves them equal.	
Viewing these lines in the light of portions of the direct line to Montreal, and of the through line to Ottawa, I have now no hesitation in recommending that No. 1, or the North Shore Line, should be adopted, and would here briefly summarize my reasons for this conclusion:—	The advantages and disadvantages of No. 4, in contradistinction to the 12 reasons why No. 1 should be adopted, are as follows:—
1st. The advantages of No. 1 are:—Between Quebec and Montreal, it is 3.15 miles shorter than No. 4, and, for the through line between Quebec and Ottawa, only 1.78 miles longer;	1st. Owing to the straightness of its alignment and having no draw-bridge, a greater speed can be attained on line No. 4, which will much more than compensate for its extra length;
2nd. It has easier grades;	2nd. If the grades on No. 1 had been *reduced*, both lines would be similar, and, therefore, neither is easier in this respect;
3rd. The general level of the road bed his igher, and will consequently be less obstructed by snow, and, therefore, can be more economically worked;	3rd. The general level of the road beds are similar;
4th. It has 22,590 feet, or over 4 miles less cutting than No. 4, and will consequently be more easily worked in winter;	4th. In reality, No. 4 has only 6066 feet, or less than one mile and a quarter more cutting than No. 1;
5th. It has 250 feet less wooden bridging than No. 4;	5th. In point of fact line No. 4 has only 100 feet more wooden bridging than line No. 1;
6th. It has 1347 feet less iron bridging than No. 4;	6th. Line No. 4 has 953 feet *less iron truss bridging* than line No. 1, without regard to *iron trestle work*. The terms have been confused by Mr. Peterson, but mean very different things;
7th. It passes through about 3 miles less of the "Grande Savane";	7th. From actual experience, I can state that a line properly constructed over formation of this nature, can be more easily and cheaply maintained than any other portion of the Road;
8th. It has no long and expensive rock cuts to delay the completion of the works;	8th. No. 4 has *one* rock-cut containing only 6.290 cubic yards. This will not delay the work, as it can be easily taken out long before the bridges are completed;

MR. PETERSON.	MR. LIGHT.
9th. It has 1968 yards less masonry, as shown by the comparative estimates; it would probably have 6000 yards less, if properly carried out;	9th. Line No. 4 has really only 2282 cubic yards more masonry than line No. 1. This excess is, however, due to shortening the bridge superstructure on this line to the least width requisite to pass the water, in accordance with the recommendations in Mr. Shanly's report. Mr. Peterson's conjectures as to line No. 1 having 6000 cubic yards less masonry than line No. 4, are of no value in the face of actual measurement;
10th. It is the original line on which the contract was based, and, by not departing from it, many disputes, delays and vexatious claims for extras, will be avoided;	**10th.** This objection has no weight, as a proper arrangement was made in the contract to cover such a contingency;
11th. I believe it can be completed sooner than No. 4;	11th. For reasons already stated, No. 4 can be completed much sooner than line No. 1, especially if taken by "Ste. Thérèse" or "Sault au Récollet;"
12th. It will certainly cost less than No. 4.	12th. The estimates prove that line No. 4 will cost $100,000 *less* than line No. 1, exclusive of land damages which, on line No. 1, would be exceedingly heavy, as that line runs through very valuable private property all the way from "Bout-de-l'Isle" to Hochelaga.
Trusting I have been able to place the merits and demerits of the various lines submitted, clearly and impartially before you,	In recommending Line 4, my only desire has been to afford the best and fullest information to the Government. Being impressed with the grave importance of a proper location of the Road, I thoroughly explored the country by some 300 miles of careful instrumental surveys, which resulted in the finding of Line No. 4. This line, with its splendid grades and alignment, admitting of easy and comparatively cheap construction, is adapted to carry the heaviest loads at the hightest speed with the least risk to life and property, and must, therefore, in every point of view, be the most advantageous line; while, viewed from a national stand-point, its location is admirably calculated to serve the interests of the whole country, at the lowest cost.
I have the honor to be, Sir, Your obedient servant,	I have the honor to be, Gentlemen, Your obedient servant,
P. ALEX. PETERSON. Government Engineer Western Section.	A. L. LIGHT.
Quebec, 27th January, 1877.	

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REPORT OF MR. S. FLEMING.

Ottawa, March 14th, 1877.

E. Moreau, Esqre.,
Secretary,
Govt. Railways, Quebec, Province of Quebec.

Sir,

The Commissioners of the Quebec, Montreal, Ottawa and Occidental Railway, having called upon me to express my views with regard to the location of a portion of the line, in the neighborhood of Montreal, and having referred to me certain reports and plans by Messrs. Light & Peterson, I now beg to state:—

I have read all the Reports and examined the plans which have been placed in my hands. I have had four or five interviews with Messrs. Light and Peterson and have listened to all the observations they have to make with respect to the merits and demerits of the lines under consideration.

From the data which have thus been laid before me, I have arrived at the following opinions:

1st. The country through which the lines are projected, is so extremely simple in its topographical character, that, leaving out of consideration the heavy bridging, there is no marked difference in the Engineering features of the lines Nos. 1 and 4 recommended by the Gentlemen referred to;

2nd. Taking into consideration the bridging across the rivers which separate the main-shore from the Island of Montreal, and comparing lines Nos. 4 and 1, the latter having a draw bridge over the Ottawa at "Bout-de-l'Isle," line No. 4 is decidedly to be preferred.

3rd. By substituting a fixed bridge at "Bout-de-l'Isle" for a draw bridge the clear headway for vessels being subject to the approval of the Department of Public Work, the cost of line No. 1 would, I think, considerably exceed that of line No. 4.

4th. Viewing the whole system of Railways now under construction by the Quebec Government, between the Cities of Quebec, Montreal and Ottawa, it would appear to me, from what I have learned during this investigation, that a portion of the location already adopted into the City of Montreal, is not wisely chosen. I am very strongly of opinion that important advantages would have resulted, if the location had been better considered in the first place. I think the line from Ottawa should have been carried to a point on the northerly side of the river des "Mille Isles," probably near Terrebonne, from which points lines to Hochelaga and

Quebec, would have occupied substantially the position of line No. 4. By this arrangement, the double bridging of these large river would have been avoided. A line with much better grades than the existing one to Montreal, would have been obtained, and the construction of 16½ miles of railway from B to D, would have been saved.

The only disadvantage would have been an increase in distance, between Ottawa and Hochelaga, of some 4 miles, but this disadvantage would have been largely compensated for by the better gradients—on the other hand, the distance between Ottawa and Quebec, would have been reduced 17 miles.

5th. It is now too late to avoid this (as it seems to me,) grave error, and I would, under the circumstances, advise the commissioners to consider the expediency, at present, at all events, of saving the bridging of these large rivers a second time by postponing the construction of that section of the line from C to D, substituting therefore, the section from C to B.

By this plan, railway communication between Quebec and Montreal, can be secured with little delay.

This plan would probably save fully half a million dollars, in the present expenditure, leaving that sum available for other purposes. It would save time in opening the line between Montreal and Quebec; and, although the line between these two cities, would be 16 miles longer than with C to D completed, it would shorten the distance from Quebec to Ottawa 17 miles, and necessitate the maintenance and operation of only one line between River "Des Mille Isles" and Montreal, instead of two, besides the interest on the cost of construction. At any time hereafter, when traffic requirements imperatively demand the establishments of the line from C to D, it may then be constructed.

I have expressed my views with regard to the comparative merits of Lines Nos. 1 and 4, pointing out that, in my judgment, the latter line is generally to be preferred.

The last part of your letter directs my attention to another line (No. 2 on the Map), by Joliette. I agree with both your Engineers in disapproving of this line, but, if an intersection with the existing Railway, at the river crossing near B, be taken as an objective point, it is quite possible that a favorable line, in the general direction I have sketched on the map, from B to F, may be obtainable. This line would pass near Joliette and would accommodate the traffic of that place. Only a survey can, however determine the other advantages it would have, if any, which line No. 4 does not possess.

I have taken the liberty of lettering the map which you sent to me, in order to simplify this report, I now return it with all the other documents.

I am, &c., &c., &c.,

(Signed), SANDFORD FLEMING.

Documents enclosed :

1. Map showing Railway Routes ;
2. Mr. Light's report, January 17th, 1877 ;
3. Mr. Peterson's report, January 27th, 1877 ;
4. Remarks on Mr. Peterson's report by Mr. Light, March 9th, 1877 ;
5. Mr. Peterson's report, March 3rd, 1877, with plan.

(A true copy),

E. Moreau,

Secretary.

REPORT ON THE COMPARATIVE ESTIMATES

OF FOUR LINES, FROM

MASKINONGE TO HOCHELAGA.

Quebec, 14th December, 1877.

To the Commissioners of the Q. M. O. & O. Railway,

GENTLEMEN,

I have the honor to enclose estimates of the cost of constructing that portion of the Eastern Division of the Q. M. O. & O. Ry, between Maskinongé and Hochelaga, by four different routes, which are depicted—in the accompanying map—by lines numbered 1, 4, 5 and 6.

The first is No. 1, or the old North Shore Line, viâ "Bout-de-l'Isle"—distance 55.41 miles;—cost, including land damage, but exclusive of stations and rolling stock, is $1,298,986. The estimate assumes the draw in the bridge at "Bout-de-l'Isle" to be done away with, and a fixed bridge, laid 36 feet above extreme high water, used instead.

The second, or No. 4 line, direct from Maskinongé to Hochelaga viâ Terrebonne and "Des Prairies," is 58.56 miles long, and the estimated cost $1,094,537.

The third, or No. 5 line, from Maskinongé to Hochelaga viâ Terrebonne and "Sault-au-Récollet," connecting near the latter place, and on the north side of the "Rivière Des Prairies," with the railway from Montreal to Ottawa, and running over some 8 miles of the latter railway into Hochelaga:—number of miles to construct, 58.03; cost of construction, $767,528.

The fourth, or No. 6 Line, is from Maskinongé viâ Terrebonne; thence along the north bank of the Ottawa to "Ste. Thérèse," connecting near the latter place with the railway from Montreal to Ottawa; thence running over the latter line some 16 miles into Montreal. This is the cheapest of the series, and is the line so strongly recommended by Mr. Fleming. It lengthens the distance into Montreal some 16 miles, and correspondingly shortens the distance to Ottawa, about 17 miles. Its cost is $710,918.

It will be seen that Line No. 1 (or the old North Shore,) when brought to the same standard of excellence as the other three lines, is the most expensive. The saving effected by adopting either of the alternative lines 4, 5 or 6, instead of No. 1, will be respectively $204,449, $531,458 and $588,068, as will be seen by examining the several Estimates.

That portion of line No. 4, between Maskinongé and Terrebonne, having been already adopted, and the clearing, fencing and grading more than half done, while some 10 miles of track are laid and ballasted, it will be more to the purpose to assume that line as the standard; and comparing Nos. 5 and 6 with it, the saving by adopting either of the latter lines, will be found to be $327,009 and $383,619, respectively.

The eastern section of line 4, between Maskinongé and Terrebonne, is common to the three lines 4, 5 and 6. It is estimated to cost $571,203. Deducting this sum from the gross cost of any one of the three lines in question, the remainder will equal the cost of either of the three western sections to which the calculation is applied. Applying this process, the cost of these sections will be as follows:—

From Terrebonne to Hochelaga, by line No. 4.........	$523,334
" " "Sault-au-Récollet," by line No. 5	196,325
" " "Ste. Thérèse," by line No 6......	139,715

The Estimates have been based on the actual quantities, as near as can now be ascertained, which will be necessary to complete the respective lines—moneyed out at similar prices; these prices being those adopted in the revised schedule dated 19th April, 1877.

It will be seen that the several estimates differ slightly from those given in my report of 17th January 1877, and in my remarks on Mr. Peterson's report on that survey. These differences are caused, in the first instance, by a change of quantities due to raising the grades and avoiding the draw-bridge, and secondly by a change of prices; the two first having been moneyed out on the prices in the original contract schedule, while the accompanying estimates are moneyed out on the revised schedule. The comparative differences will be found in each case very similar. These differences of cost between the several lines, are the least that could occur, as no percentage has been added for contingencies which are liable to arise in direct proportion to the heaviness of the works, and which might, therefore, tend to swell the cost of lines Nos. 1 and 4 more than that of lines Nos. 5 and 6.

In addition to the lines shown on the accompanying map, a survey was made from Maskinongé to Hochelaga *viâ* Lachenaye. This was found to be more expensive than the shore or No. 1 line; it involved two draw-bridges, instead of one, and was, therefore, omitted from the map. It has been laid down on the office plan and can, of course, be examined by any one wishing to do so.

The base or—"thin red line"—first run from Berthier to Terrebonne and mentioned in my report of 17th January 1877, has also been omitted to avoid confusion.

I have the honor to be
Gentlemen,
Your obedient servant,
A. L. LIGHT.
Government Engineer, Eastern-Section.

Line No. 1 (viâ "Bout de l'Isle").

Estimate of Shore Line from Maskinongé to Hochelaga. Grades raised, bottom of truss at Ottawa River,—36 feet above high water.

Earth excavation	825,550	c. yds.	@ 0.20 cts.	$ 165,110
" " To raise grades.	617,000	"	@ 0.28 cts.	172,760
1st. class masonry	13,618	"	@ 12.	163,416
2nd. " "	4,500	"	@ 6.	27,000
Rip-rap	57,686	"	@ 1.	57,686
8 Deep water foundations		"	@ 7000.00	56,000
Iron truss bridging	2,020	lin. ft.	@ 90.	181,800
Wooden " "	750	"	@ 30.	22,500
Ties	146,336	"	@ 0.20 cts.	29,267
Steel rails	4876.08	tons	@ 45.	219,423
Spikes and joints	277.05	"	@ 55.	15,237
Tracklaying	55.41	miles	@ 200.	11,082
Ballasting	55.41	"	@ 500.	27,705
Land damage				150,000
				1,298,986
Cost of No. 4, as per Estimate attached				1,094,537
Saving by line No. 4				204,449
Line No. 1, as above				1,298,986
Line No. 5, as per Estimate attached				767,528
Saving by line No. 5				531,458
Line No. 1, as above				1,298,986
Line No. 6, as per Estimate attached				710,918
Saving by line No. 6				$ 588,068

Note.—These Estimates are made up of principal items for comparison, and are all moneyed out at prices arranged for revised Schedule, dated April 19th, 1877. Fencing, Stations, and Rolling Stock being common to all, are not included.

Line No. 4 *viâ* Terrebonne—(Length 58.56).

Estimate from Maskinongé to Hochelaga viâ Terrebonne. Revised Grades; bottom of truss at "Des Prairies" river,—36 feet above high water.

Earth excavation	1,162,950	c. yds.	@ $ 0.20 cts	$232,590
Rock "	6,290	"	@ 1.	6,290
1st class masonry	15,900	"	@ 12.	190,800
2nd " "	2,700	"	@ 6.	16,200
Rip-rap	38,340	"	@ 1.	38,340
4 deep water foundations			@ 7,000.	28,000
Iron truss bridging	1,387	lin. ft.	@ 85.	117,895
" trestle	2,300	"	@ 30.	69,000
Wooden bridging	850	"	@ 30.	25,500
Ties	154,657	"	@ 0.20 cts	30,931
Steel rails	5153.28	tons	@ 45.	231,897
Spikes and joints	292.80	"	@ 55.	16,104
Tracklaying	58.56	miles	@ 200.	11,712
Ballasting	58.56	"	@ 500.	29,280
Land damage				50,000
				$1,094,537

Cost of Line No. 5, as per estimate attached	767,528
Difference in favor of line No. 5	$ 327,009
Cost of line No. 4, as above	$1,094,537
" " No. 6, as per estimate attached	710,918
Difference in favor of line No. 6	$ 383,619

Line No. 5 (*viâ* "Sault-au-Récollet").

Estimate from Maskinongé to "Sault-au-Récollet" *viâ* Terrebonne and "St. Vincent de Paul,"—Line No. 5; Length 58.03 Miles.

Earth excavation	818290	c. yds	@ 0.20 cts	$163,658
1st class masonry	11590	"	@ $12.	139,080
2nd " "	2708	"	@ 6.	16,248
Rip-rap	24340	"	@ 1.	24,340
Rock excavation	6290	"	@ 1.	6,290
Iron bridging	650	lin. ft	@ 70.	45,500
Wooden "	850	"	@ 30.	25,500
Ties	153245		@ 0.20 cts	30,649
Steel rails	5104.28	tons.	@ 45.	229,692
Spikes and joints	290.00	"	@ 55.	15,950

Tracklying	58.03 miles.	@ $200.	$11,606
Ballasting	58.03 "	@ 500.	29,015
Land damage			30,000
			$767,528

NOTE.—Prices in accordance with revised Schedule, dated 19th April 1877.

Line No. 6 (*viâ* "Sainte-Thérèse"

ESTIMATE from Maskinongé to Sainte-Thérèse (line No. 6), *viâ* Terrebonne. (Length 58.03 miles.)

Earth excavation	875,590 c. yds.	@ $ 0.20 cts	$175,118
1st class masonry	10,400 "	@ 12.	124,800
2nd " "	2,708 "	@ 6.	16,248
Rip-rap	24,340 "	@ 1.	24,340
Wooden bridging	950 lin feet	@ 30.	28,500
Ties	153,245	@ 0.20 cts	30,649
Steel rails	5104.28 tons	@ 45.	229,692
Spikes and joints	290 "	@ 55.	15,950
Tracklaying	58.03 miles	@ 200.	11,606
Ballasting	58.03 "	@ 500.	29,015
Land damage			25,000
			$710,918

NOTE.—Prices in accordance with revised Schedule, dated 19th April, 1877.

The above Estimates are compiled from the most reliable data available. The quantities on all the lines are estimated on the same basis and moneyed out at similar prices, so that, for purposes of comparison, they are substantially correct.

JOHN EDWARD BOYD,
Resident Engr. Div. No. 3,
Maskinongé to Hochelaga.

E. A. HOARE,
Principal Draftsman.

APPENDICES.

APPENDIX No. 1.

General description of surveys, mode of computing estimates, with remarks on overflowed lands at Berthier, and method of constructing Line through "Grande Savane," &c.

The Board having decided to make a thorough survey of the whole country, between Maskinongé and Hochelaga, with a view to ascertain the best line for the North Shore Railway, I was instructed to proceed with the work on the 28th July 1876. I at once organized two efficient surveying parties under Mr. Charles C. Gregory, C. E., a skilful and energetic engineer, with instructions to make first a careful survey of the line from

Maskinongé, through Joliette, Terrebonne and "St. Vincent de Paul," to Hochelaga, which was done.

The report on this survey (appendix 2,) proving the unsatisfactory nature of the line, Mr. Gregory was directed to explore an intermediate line between Maskinongé and Terrebonne direct.

The intervening country being little known, from an engineering point of view, Mr. Gregory was instructed to run first a straight-base line of survey from Berthier to Terrebonne (shewn by a thin red line on the Map,) taking full topographical notes of the general features of the country, as he proceeded, for about a couple of miles on either side: shewing particularly the position and form of the several rivers, "savanes," "côteaux," summit-heights, &c. *

This survey disclosed an exceedingly easy line of country, as far as Terrebonne, with an excellent crossing of the river there, while the portion, between the latter place and Hochelaga, was better than the corresponding portion between "Bout-de-l'Ile" and Hochelaga.

By means of the topographical map he was now able to prepare, Mr. Gregory designed and surveyed another line through this same section, marked 3,—or blue line throughout,—described at length in his report, (appendix 3.) This line, it was thought at the time, afforded the best crossing of the several rivers, "savanes," "côteaux," &c. It will be seen, however, that it encountered an unforseen ridge of high land, east of the "L'Assomption" river, and another east of "St. Vincent de Paul," necessitating steep grades, sharp curves and heavy work to overcome, also much damage to property at "St. Vincent de Paul."

It was considered desirable to avoid these difficulties, if possible.

The No. 3 line having been plotted with its accompanying full topography, it became clear that a straight line—38 miles long—marked 4 on the map, and named "heavy red line throughout" in Mr. Gregory's supplementary report (appendix 4,) could be so placed as to entirely avoid the before mentioned summits, keep equally clear of the flooded lands near Berthier, and cross most of the rivers, nearly as favorably, although passing through 4, instead of 3½ miles, of the "Grande Savane"; but I will guarantee that no difficulty need be feared here.

Between Terrebonne and Hochelaga, by crossing the river "Des Prairies" some 3 miles lower down the stream, (where the actual water-way need be no wider,) the grade level can be kept sufficiently above the river to avoid a draw-bridge, thus meeting Mr. Gregory's objections in his supplementary report. The steep grades and heavy works, as well as the damage to church property at "St. Vincent de Paul," can be avoided, and the line thereby shortened a mile and a half.

By this change the grades are reduced from 52.8 to 26 feet per mile, both ways, and the total number of degrees of deflection from 240 to 86 degrees, while the maximum radius is increased from a third to a whole

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NOTE.—* The thin red line has been omitted from the map, to avoid confusion.

mile. The actual cost of building this line exceeds that of the No. 3 line by $8,867, but the far greater facilities it offers to traffic, infinitely outweigh such a trifling consideration.

All the lines have been carefully surveyed. The actual mileage of instrumental survey made during the past autumn, exceeds 800 miles.

The estimates of cost,—given in appendices 6 and 7,—are made from known data ; nothing has been assumed.

The depths of the several streams, bogs, &c., have been carefully sounded and all levels checked.

The prices for similar items are identical in all the estimates. They are the schedule prices of the present contract ; were current prices used they would be reduced twenty per cent. The items of land damage' stations and rolling stock,—common to all the lines,—have not been included'

FLOODED LANDS NEAR BERTHIER.

Especial reference, with regard to these lands, is made in Mr. Gregory's report on the Joliette line (appendix 2.) This report having disclosed a considerable discrepancy in the original levels, west of Maskinongé, after Mr. Gregory's departure, Messieurs Garden & Gauvreau, who had made the surveys for the interior lines through the same flooded district, were sent to make a careful survey of the whole of the submerged district on the old North Shore or No. 1 line, using the same datum, flood levels, &c., on all. Their report is attached (appendix 5.) It will be seen, amongst other discrepancies, that a considerable portion of the grade levels, on the original contract profiles, has been laid below high water mark, to rectify which, the quantities of earth-work and masonry will be largely increased.

REMARKS ON THE "GRANDE SAVANE."

Should either of the direct lines be adopted, they will pass, for some distance, through this swamp ; direct Line No. 4 passes 4 miles through it. It is not a soft bog, as will be seen by Mr. Gregory's report, and there is no danger in making a Railway over such ground, if properly constructed. The grades should be laid not more than 3 feet above the surface (this can be done here, as the ground is practically level throughout.) The side slopes should be laid two horizontal to one perpendicular, to give more base. The whole seat of the embankment should be covered in advance with a good coating of timber and brush wood which abound in the neighbourhood ; no side ditches should be dug. The material composing the embankment should be brought (by train) from the neighbouring côteau which is in close proximity, along the greater portion of the line. Miles of the Intercolonial Railway were so made by the writer with perfect success ; they are the best parts of the line and the cheapest, mile for mile. From its elasticity such a line can be easily maintained.

Thanks are due to Mr. Gregory for the energetic manner in which he completed the survey entrusted to him. Imperative private business unfortunately called him away to the Maritime Provinces, before the estimates were made. His assistants, Messieurs Ramsay, Cadman, Garden and Gauvreau, therefore, have had to complete this work under great disadvantages.

Quebec, 17th January 1877.

A. L. LIGHT,
Government Engineer,
Eastern-Section.

APPENDIX No. 2.

Report of the line of survey, *vid* Joliette and Terrebonne, for the North Shore Railway (C. C. Gregory).

A. L. LIGHT, ESQ.,
Engineer-in-Chief.

SIR,

Herewith are submitted plans and profiles of the line which has just been surveyed in accordance with your directions.

Leaving the former location at station No. 1214, near Maskinongé river, the new line has a deflection from tangent on the located line, of but three degrees to the right; so that, for a considerable distance, the lines are very near each other, the space between them being, at the distance of a mile from the starting point, only 500 ft.; at the distance of two miles, 2000 ft. and at three miles, 3600 ft.

The ground is so very uniform, and the lines being near each other, they have nearly the same height of surface to traverse for the first six miles.

What little difference exists is in favor of the located line, as will be seen by the following comparative memoranda of the flowage on the respective lines by the freshet of 1865, for the first 6 miles from the point of divergence at Maskinongé:—

LOCATED LINE.

Depth of Water.	Distance.
7 feet for	500 ft.
6 " "	6000 "
5 " "	4000 "
4 " "	3000 "
3 " "	7000 "
2 " "	2000 "
1 " "	500 "
Total :	23,000 feet.

JOLIETTE LINE.

Depth of Water.	Distance.
7 feet for	800 ft.
6 " "	6000 "
5 " "	4000 "
4 " "	4000 "
3 " "	8000 "
2 " "	3000 "
1 " "	700 "
Total :	26,500 feet

There appears to be inaccuracy in the levels and profiles of the located line, the ground surface for 4,500 feet being shown 9 feet lower than it actually is, and thus the idea of flooding gained from the profile would be greatly exaggerated. The grades drawn to accommodate this depression of ground, which does not exist, descend below the flood level.

The Joliette line, after the 6th mile, leaves the flooded ground.

The located line encounters the flood of 1865, level again on the 8th mile, and runs through it for the space of 1½ miles, but only in a depth of from one to one and a half feet of water. The water level of that year is again encountered on the 12th mile and passed through, for a distance of 12,000 feet, with the following depths:—

Depths of water.		Distance.
7 feet for	... ...	400 feet
6 " "	... ...	300 "
5 " "	... ...	3,000 "
4 " "	... ...	3,200 "
3 " "	... ...	1,800 "
2 " "	... ...	2,300 "
1 " "	... ...	1,000
	Total........................	12,000 feet

This 12,000 feet in length, varying from one to seven feet in depth in the freshet of 1865, represents the excess of water flooding on the located line over that on the Joliette line.

On the 10th mile the Joliette line commences the ascent of the first côteau, which is surmounted by a grade of 37 feet per mile, 6,400 feet in length. The ground then is comparatively level, but slightly raising as we proceed. In this stretch we cross the rivers "Chicot," "St. Norbert" and "Bayonne," and two minor streams at heights from 25 to 35 feet above their beds.

After passing "Bayonne" river, we ascend, with a grade of 26 feet per mile, for a distance of 6,800 feet, and then, with a grade of 52.8 feet per mile, for a distance of 3,400 feet. The surface then is comparatively uniform, but gradually ascending, so that the ground reaches the height of 202 feet, and the grade 198 feet, about two miles east of Joliette: this is the summit. The grade then is nearly level and has a height of 195 feet at Joliette, and then falls for half a mile, where the line crosses the river "l'Assomption" at a height of 55 feet above the bed.

The grades then undulate until we come to the 28th mile, where we cross the rivers "Rouge" and "Ouareau," within half a mile of each other, at the heights of 38 and 53 feet, respectively, above the beds.

There is nothing worthy of remark from thence, until we come to the river "St. Esprit," which we cross about the 36th mile at the height of 66 feet above the stream bed, and a valley 1,100 feet wide and 60 feet deep.

The next point worthy of remark is the "L'Achigan" river, which is crossed, about the 38th mile, at a height of 66 feet above the bed of the stream.

The ground then gradually descends and we cross the "Mascouche" river, about the 45th mile, at a height of 23 feet above the bed of the stream.

The surface and grades are then very uniform and there is nothing to note, until we come to Terrebonne river, which is crossed, about the 50th mile, with 700 feet of water-way at present height and 1,400 feet at freshet level. The bottom is rock and the water at present 7 feet at the deepest point. No great elevation is encountered in passing from Terrebonne to "rivière Des Prairies," at "St. Vincent de Paul;" the grade at the summit rising only 44 feet, about what it is at Terrebonne. The ascent and descent is made, on both sides of the summit, with grades 26.4 feet per mile.

At "St. Vincent de Paul," owing to a bold escarpment of rock on the north side of the river, some very heavy rock excavation would be required, unless the river is crossed obliquely by a skew-bridge. The present water-way is 900 feet, as crossed, and the depth of water 28 feet. The bottom appears to be ledge rock and boulders. A skew-crossing would, of course, increase the width of water-way. The grade is 24½ feet above the present water level, and 52½ feet above the lowest bed of the river.

From the "rivière Des Prairies," the ground rises sharply and is ascended by 5,100 feet of grade rising 52.8 feet per mile, then 2,700 feet of level, then 6,300 feet of grade rising 29 feet per mile, then 4,500 feet of level, then 6,100 feet of grade rising at the rate of 52.8 feet per mile.

The summit has 1,500 feet of level grade, and then a descent for 4,300 feet, at the rate of 52.8 per mile, brings us to the crossing of the Northern Colonization Railway, at a point 1,800 feet beyond the summit of the steep 84 feet per mile grade with which that line ascends the côteau at Hochelaga.

The chief part of the route, after we reach the côteau, about the 10th mile, to the connection with the Northern Colonization line, the rock is very near the surface of the ground and would probably be met in most of the cuttings.

The rivers "Rouge," "Ouareau," "St. Esprit" and "L'Achigan" are too large to pass through arch culverts, and the height of the grade above them is too great to build abutments to retain the embankments; so that bridges, with at least three spans not less than 100 feet, would be required at each river.

The most economical method of crossing these rivers, would be by means of Iron trestle work, as the quantity of material required for the construction of embankments, would be so immense, reaching—in round numbers—as follows:—

"L'Assomption"............................	28,000	cubic yards.
"Rouge"......................................	26,000	" "
"Ouareau"....................................	60,000	" "
"St. Esprit".................................	264,000	" "
"L'Achigan".................................	84,000	" "
Total.................	462,000	cubic yards.

The length of the line, from the point of divergence near Maskinongé to the junction with the Northern Colonization line, is 61½ miles, and to Hochelaga, about 63 miles *viâ* the Joliette line.

The distance between the same point near Maskinongé, *viâ* the located line, is 56 miles to Hochelaga

The excess of length of the line, by way of Joliette, is thus 5½ miles to be constructed, if the junction is made with the Northern Colonization Railway at the point above described. In passing from Montreal to Quebec, however, the mileage of each train would be increased seven miles *viâ* Joliette, as the distance of one and a half miles of the Northern Colonization Railway—made common to both lines,—must be taken into consideration.

In view of all the circumstances, I think you will consider the small decrease of water flowage to the extent of 33 per cent on the Joliette line, as compared to the located line, to be nothing, when it is so overwhelmingly off-setted by the inferiority of the Joliette line, in point of extra length, of heavy grades and of large percentage of cuttings.

The extra length of 7 miles, to be run by every train, would be a heavy tax upon the resources of the Road and would stand thus :—

Supposing two express trains, one mixed and two freight trains to run daily each way—a very moderate traffic,—the extra distance would be seven miles for ten trains, or 70 miles extra train mileage per day, equal to 21910 miles extra mileage of trains per year, which, at 85 cents per mile, (a figure which experience has shown to be an average,) amounts to $18,623 which, at six per cent, represents a capital of $320,000.

The above calculation is based upon the supposition that the deviation only affected the traffic by its extra length, but a more important element, in cost of working the Road, is the heavy grades rendered necessary on the Joliette line.

An engine with 32,000 lbs. weight on her driving wheels, will draw the following gross loads on the several grades specified :—

On a level			760	tons,	42	Cars.
Up a grade of	20ft.	per mile	360	"	22	"
" "	30ft.	"	280	"	17	"
" "	40ft.	"	226	"	14	"
" "	50ft.	"	188	"	12	"
" "	52.8	"	179	"	11	"
" "	84	"	114	"	7	"

The cars being reckoned as loaded, platform cars 16 tons each, viz : 6 tons for car and 10 tons for load.

Bearing these figures in mind, we see that an engine fully loaded with seven cars, on the 84 feet grade, would have only 64 per cent of its load when on the 52.8 feet grades, and only 50 per cent on grade of 40 feet per mile, and only 41 per cent on 30 feet grades ; the one or the other of which two last mentioned, I believe, is the contemplated maximum grade on the located line between Three-Rivers and Montreal.

It would thus appear that the Joliette line would completely cripple the efficiency of the line, as regards freight traffic.

The next point is the frequency of cuttings on the Joliette line. An inspection of the profile will show that fully 25 per cent of the distance would be through cuttings, many of them deep and in rock. These cuttings would fill in with snow drifts in the winter, and give rise to much delay and expense in working the Road, and would be at variance with the policy you have pursued in all other parts of the line of keeping the road-bed above the surface.

I have not gone into the comparative cost of construction particularly, but it is apparent at a glance that the cost per mile would be greater on the Joliette line, so that the increase would be at least the mileage price of contract for the extra 5½ miles.

All of which is respectfully submitted.

CHARLES C. GREGORY,
Engineer in charge of Survey

APPENDIX No. 3.

Reports on Line *viâ* "L'Epiphanie," Terrebonne and "St. Vincent de Paul" (C. C. Gregory.)

A. L. LIGHT, ESQ.,
Engineer-in-Chief,
Q. M. O. & O. Railway.

SIR,

Having completed the surveys of the intermediate lines *viâ* "L'Epiphanie," Terrebonne, &c., I beg to submit the plans and profiles together with the following remarks.

After having completed the survey of the line *viâ* Joliette, and submitted my report, we proceeded to run out the straight line, from the curve east of Berthier, direct to Mascouche.

Owing to the crooked course of some of the streams and rivers, this line proved to cross the rivers "Bayonne," "Chaloupe," "L'Assomption" and "Mascouche," at angles not very favorable for bridging.

The line traversed the "Grande Savane," for a distance of seven miles, in portions of which distance the depth of bog was very considerable. A glance at the profile will give a better idea of the depths than any written description.

This "Grande Savane" is not a soft bog; a man can walk any where over it without sinking in it, and it is covered with a growth of trees over the greater part. These trees are, in some places and, indeed, where the deepest soundings were obtained, of very large sized pines and junipers; yet, at the same time, one can with ease force an iron rod down to the depths shown on the profile. Owing to the undesirable crossings of the above mentioned rivers, and the length of bog traversed by the said straight line, we proceeded to run another line from "Chicot" river to Terrebonne, making good crossings at all the rivers and running to the northward of the great area of the "Grande Savane." This line is shown on the plan in blue (No. 3.)

It was found impossible to get one continuous straight line which would cross all the rivers properly. It was, therefore, found necessary to break the line between "Chicot" river and Terrebonne, being a distance ot 38 miles into four tangents.

Owing to the "L'Assomption" river making a bend towards the line (as run,) at a point three miles east of the crossing of that river, it was found impossible to run the line far enough north to avoid the above mentioned swamp altogether, without making a greater deviation from the general direction of the line, than was thought desirable. To carry the crossing of the line over "L'Assomption" river any further northward, and thus up stream, would have necessitated several extra heavy bridges over the "Lac Ouareau" and several other streams, tributaries to the "L'Assomption" river on the northern side.

The extent of bog traversed by this line, will be found described below and also shown on the accompanying profile.

Between Terrebonne and Hochelaga, three routes were surveyed, viz: —one *viâ* "St. Vincent de Paul," another—direct, and a third—deviating two miles from the direct line, south-easterly, and crossing the "rivière Des Prairies," at a rocky island, about mid-way between "St. Vincent de Paul" and the crossing of the formerly located line, at the "Bout-de-L'Isle."

The last mentioned of these routes has a very good crossing of the river, being eleven hundred feet in width, two hundred of which is over the island, and rock foundation throughout. The approach, however, from the south-western side, is so steep as to render the line impracticable without breaking off very much from the general direction and introducing a considerable amount of sharp curvature. The direct line, between Terrebonne and Hochelaga, can hardly be entertained on account of the width of the river crossing, which is twenty-seven hundred feet.

The intervening island being swampy would not diminish the cost of bridging. The approaches and bed of the river are also soft ground.

The third and only remaining route is *viâ* "St. Vincent de Paul." This line is shewn on the plan in blue (No. 3) and, with the blue line to east-ward of Terrebonne on the map, forms one continuous route between Hochelaga and "Chicot" river, *viâ* "St. Vincent de Paul," Terrebonne and "l'Epiphanie," and is that hereafter spoken of and described ; no further reference being made to the other lines or routes run.

DESCRIPTION OF BLUE LINE.

This line leaves the former location at station 1710 near the "Chicot" river, and, by keeping on higher ground, avoids the flowage of back water, near Berthier, almost altogether. The general surface of the ground is very uniform and firm for nine miles. In that distance the line crosses the "Chicot," "Bayonne" and "Chaloupe" rivers—all clay or sand bottom, probably requiring pile foundations for the bridges and the following spans: "Chicot"—60 ft., "Bayonne"—100 ft., "Chaloupe"—40 ft. All the said crossings would be similar to those on the respective rivers on the original location.

At station 2186, the line enters a swamp which it traverses for a distance of two thousand feet, the depth of which, for a distance of eight hundred feet, is upwards of fourteen feet. The swamp is moderately firm and is covered with a heavy growth of junipers.

About station 2240, a swamp is traversed, for 1700 feet, at depth varying from one to five feet.

About station 2300, a swamp is crossed, with a width of twenty-five chains, with depth varying from one to eleven feet.

The south-west branch of the "Chaloupe" river,—a stream about ten feet wide,—is crossed three times at distances of a mile a-part ; two of the said crossings occur in the above mentioned bogs.

About station 2380, a bog is encountered and traversed for a distance of twenty-seven chains, four of which have a depth of over eleven feet.

At station 2436, the line again enters a swamp and continues in it to station 2476 : a distance of three quarters of a mile,—a very considerable portion of which is nine feet in depth, and four hundred feet exceeds eleven feet. This bog is also moderately firm and is covered with small mixed growth of soft wood.

At station 2504, the numbering of the stakes begins again at zero; the stake which would have been 2505 being numbered *one*.

At station 60 (new series) an elevation of surface of ground, rising rather abruptly to 35 ft. above the general level, is met. The ground traversed has this higher elevation as far as station 118, where, by an abrupt descent, the surface falls again to the general level. The ascent and descent of this côteau would necessitate grades as steep as 40 feet per mile, and would then have long cuttings and embankments.

The surface of the ground is then very uniform to station 302. Here the "L'Assomption" river is crossed at a height of thirty feet above the bed, and with a width of water-way of 180 ft., at summer level. The crossing is at right angles to the stream. The sides and bed of the stream are clay.

The surface is then very uniform until we reach station 476, where we cross the "St. Esprit" river, at a height of twenty-five feet above the level of the stream. The water is 160 feet wide, at present, running over flat ledge rock, with a depth of only a few inches. A bridge, with 80 feet span, would be sufficient and the foundations easily could be laid without trouble from water.

The surface is level from thence to the station 546 where we cross the "L'Achigan" river with 60 feet width of water-way, and 18 inches depth at summer level: water rapid, running over rock ledge.

Just east of the "L'Achigan" river, we pass through "L'Epiphanie," the line taking three houses and two barns. The probable value of the buildings would be about $2600.

At station 563 a hill of rock is met and passed through with a cutting 500 feet long and depth of 17 feet, requiring about 6000 cubic yards of rock excavation.

Great uniformity of ground then prevails up to station 805 (new series,) when a small brook, ten feet in witdh and depth of from five feet to ten feet below general surface, is met running lengthwise with the line and crossing and recrossing it several times in the space of 4000 feet.

This brook may either be crossed twice by ten feet open bridges, or diverted without any crossing. It was not considered as offering such obstacle as to make it worth while to break up the tangent of fourteen miles in length with favorable crossings of other streams.

The surface is then very uniform to Terrebonne; the only stream of any importance encountered being the "Mascouche" river which is crossed, at station 963, at a height of 30 feet above the bed of the stream with 70 feet width of summer water-way and four feet depth. The bottom is clay and would probably require pile foundations; a span of 80 feet would be sufficient for a bridge.

At station 1193.32, there is another break in the chainage: that point corresponding with 715.60 of a system numbering from "St. Vincent de Paul." The numbers will now decrease going towards Hochelaga.

The "rivière des Mille Isles" is crossed about half a mile below the toll-bridge. The water-way, in summer level, is 700 feet in width; the greatest depth at time of survey was three feet. The bed of the river appears to be boulders probably lying upon ledge rock. The freshet rise of water appeared, from marks, to be 15 feet above summer level. Seven hundred feet of bridging would be sufficient. No very great rise of ground is met between the "rivière des Mille Isles" and the "rivière des Prairies." With moderately heavy work, grades of 30 feet per mile would be practicable until we come within a mile of the latter river.

The ground, for a mile on each side of the "rivière des Prairies," is very rugged, necessitating heavy grades and heavy work in both earth and rock. The "rivière des Prairies" will require to be bridged with 950 lineal feet of superstructure, and at probably a height of 40 to fifty feet above the bed of the stream. The water was, at time of survey, 28 feet deep in channel

The bottom appeared to be rock ledge and boulders. Through the village of "St. Vincent de Paul," the damages to house property will be heavy. This could only be avoided by adopting sharp curves and broken alignment in the vicinity of the village.

From a point—a mile south-west of "rivière des Prairies" to Hochelaga, an easy section has been obtained with a good alignment.

The line by this route would be four and three quarters miles longer than by the located line, *vià* "Bout-de-L'Isle." A trial line was run from our line near "St. Vincent de Paul," along south-west side of the "rivière des Prairies," to connect with the Grand Trunk Railway at "Pointe Claire." The distance was 13¾ miles and the ground very favorable for railway construction.

The course of the line is shewn on the plan and a profile is submitted.

Having placed all the points that occur to my mind before you, I will leave the question of balancing the extra length of 4¾ miles, against the avoiding a draw-bridge, without venturing an opinion, complicated as the question is as regards the longer line surveyed, but with shorter connections with western lines.

All of which is most respectfully submitted.

C. C. GREGORY,
Engineer in charge of Survey.

Quebec, 4th November, 1876.

NOTE BY THE CHIEF ENGINEER. (4)

The above report Mr. Gregory withdrew, replacing it by a supplementary one. It is inserted here on account of the full information given of the country. Subsequent examinations have proved the superiority of the direct line No. 4, and done away with Mr. Gregory's objections.

APPENDIX No. 4.

SUPPLEMENTARY REPORT (CHARLES C. GREGORY).

A. L. Light, Esq, C. E.
Engineer-in-Chief,
Q. M. O. & O. Railway.

Sir,

On the plan of my recent survey, which I leave in your office, you will find two lines laid down, one in blue color—which will be designated for distinction "The Blue Line No. 3," and the other in broad red color—which we will describe and refer to as: "The heavy red line No. 4."

The "Blue line" was run after the straight line had been run and found to traverse so much of the "Grande Savane." The object was to keep out of a portion of the swamp. I leave a report of that line, which I had prepared before our interview to day.

That interview has done away with the necessity of that report, but still I think it may be as well to leave it with you for reference in case of necessity.

At our interview you appeared more favorably impressed with the direct line, between Hochelaga and Terrebonne (crossing a wide portion of the river,) than I thought you would have been, and, therefore, my remarks concerning the crossing of that line over the river "Des Prairies," is not likely to prove such an obstacle to its adoption, as I stated in my report of the said line.

I leave two continuous profiles, one of the blue or No. 3 line on the plan, the other an approximate profile of the heavy red or No. 4 line

The choice would then appear to be as follows, mentioned in order of survey, without regard to merits :—

1. Original Location,—

Recommendation: its shortness;

Disadvantages: the necessity for a draw in the bridge over Ottawa River; great length of bridge;

2. Joliette Line,—

Recommendation: no draw-bridge;

Disadvantage: greater length, viz:

7¼ miles longer than No. 1.
2½ " " " " 3.
4 " " " " 4.

3. Blue Line throughout,—

Recommendation: good crossings at "rivière des Prairies," Terrebonne and all other rivers; shorter by 2½ miles than Joliette line, and summit 109 feet lower; no draw-bridge.

Disadvantage: 4¾ miles greater length than No. 1; some heavy cuttings and grades between swamp and bend of "L'Assomption" river; 3½ miles of swamp;

Heavy grades and cuttings approaching "rivière des Prairies"; house and land damages in "St. Vincent de Paul" and "L'Epiphanie," estimated about $50,000.

4. Heavy Red (No. 4) Line throughout,—

Advantages: 4 miles shorter than No. 2 and 1½ miles shorter than No. 3; good grades east of "L'Assomption" river and approaching "rivière des Prairies"; avoidance of heavy land damages at "St. Vincent de Paul," as compared to No. 3;

Disadvantages: heavy embankment of 290,000 cubic yards at crossing of "rivière des Prairies"; 3¼ miles greater length than No. 1; possibility of Government (Dominion still requiring a draw on bridge over "rivière des Prairies," as this crossing is not at head of navigation at high water of tug steamers going up for rafts.

In the above abstract, I have not mentioned the facility for making connections with western lines, enjoyed by Nos. 2, 3 and 4 over No. 1, or as compared with each other: all that information you are master of. Nor have I mentioned the fact Nos. 2, 3 & 4, by taking a higher ground back of Berthier, are not so much subject to back water in high freshets. I do not attach much importance to this back water, as it is dead water and banks may easily be protected. The traversing of the swamp by lines 3 & 4, would about offset the advantage they have over No 1, in respect of this freedom from flowage of back water: No 1 being free from swamp.

All of which is respectfully submitted.

CHAS. C. GREGORY,
Engineer in charge of survey.

APPENDIX No. 5.

Chief Engineer's Office,
Q. M. O. & O. Railway,
January 16th, 1877.

Report on re-survey of the "Old Location" between *Maskinongé and Berthier.*

A. L. LIGHT, ESQ.,
Engineer-in-Chief, &c.,

SIR,

Arrived in Berthier about the middle of November last, we proceeded to trace out and level over the above mentioned portion of the "old location,"—in length twelve and three quarter miles,—with the following results:—

Being satisfied of the correctness of the levelling (all of which was gone over twice, and portions of it oftener, during the past summer,) it appears, upon comparing the correct profile with the original, that the latter is erronous, the surface line being shown thereon as ranging, all the way, from nine feet below to four feet above the actual surface.

The grades are also shewn, over a distance of six and a quarter miles, as being submerged or lower than the water level of the freshet of 1865, to depths varying from nothing to five feet.

The datum used was the same as that upon which Mr. Gregory based his surveys during the past summer, that is to say: from bench marks found upon the Line, as described in a list furnished from your office.

It also appears, by calculations from the correct profile, that 77,000 cubic yds. or, about 50 per cent extra, over and above the original estimate, will be required on this twelve and three quarter miles, to build the embankment to an elevation less than one foot higher than the surface of the water during the high freshet of 1865, and the quantity of masonry will be also necessarily increased to a considerable extent.

Respectfully submitted,

G. H. GARDEN, Engr. in charge of Survey.
N. BELLEAU GAUVREAU, Leveller.

APPENDIX

Q. M. O. & O. RAILWAY,—

TABULATED STATEMENT of Distances, Grades, Curves, Quantities, &c.

	Distance in Miles.	Total degrees curvature.	Maximum curve.	Percent. of curvature.	Total rise feet.	Total fall feet.	TABLE OF GRADES.						EXCAVATION.	
							Level, Miles.	10' & under per mile.	10' to 20' per mile.	20' to 30' per mile.	30' to 40' per mile.	40 to 52.8 per mile.	Earth c. yards.	Rock c. yds.
No. 1.....	55.41	181°40'	3° 0'	0.049	223	196	27.69	13.73	5.68	5.13	1.50	1.68	825.550 160.000 985.550	403
No. 2.....	62.57	325°50'	3° 0'	0.073	380	359	25.94	11.66	8.54	12.46	1.97	2.00	1202.420	48.340
No. 3.....	60.15	249° 0'	3° 0'	0.056	266	238	27.72	14.63	5.34	12.46	......	......	899.180	30.190
No. 4.....	58.56	86° 0'	1° 0'	0.027	230	203	27.40	14.75	6.59	9.83	......	......	962.250	......
	11.90	......	......	......	......	......	......	......	......	......	......	......	143.440	......
	11,56	......	......	......	......	......	......	......	......	......	......	......	392.310	......
	13.12	......	......	......	......	......	......	......	......	......	......	......	329.250	30.190
No. 5.....	11	......	......	......	......	......	......	......	......	......	......	......	148.290	30.190
No. 6.....	10	......	......	......	......	......	......	......	......	......	......	......	205.480	......

158.37	Quebec to Hochelaga *viâ* "Bout-de-l'Ile," Shore line No. 1......
165.56	" " " Joliette, Terrebonne and "St. Vincent de Paul," **No. 2**
163.11	" " " Terrebonne and "St. Vincent de Paul" (blue), **No. 3**
161.52	" " " Direct, **No. 4**......
177.00	" " " "Ste. Thérèse" Junction and **N. C.** Railway ......
173.00	" " " Grand Trunk Railway......
160.74	" " " "Ste. Thérèse" Junction *viâ* Terrebonne......
11.90	"Bout-de-l'Ile" to Hochelaga......
11.56	Terrebonne " " ......
13.12	" " " *viâ* "St. Vincent de Paul" ......
10.00	" " "Ste. Thérèse" Junction, No. 6......
11.00	" " "Sault-au-Récollet" *viâ* "St. Vincent de Paul," **No. 5**......

No. 6.

Eastern Division.

from a common point near Maskinongé to Hochelaga, as per Route.

Iron bridge superstruct.; Lin. feet	Iron trestle bridging; Lin. feet.	Wooden bridge superstructure Lin. feet.	First-class Masonry.	Estimated cost. Total $	Cost per Mile. $	REMARKS.
						To bring grades to 26.4 per mile.
2340	....	750	10.821	1.229486	22.188	Shore line No. 1.
[illegible]	....	1760	24 700	1.457061	23 286	No. 2 – *Viâ* Joliette, Terrebonne and "St. V. de Paul."
1387	....	1100	11.500	1.131243	18,807	No. 3—Blue line throughout.
1387	2300	1100	12,502	1.140110	19.503	No. 4—Direct line.
2340	....	....	7.221	548703	46.109	"Bout-de-l'Ile" to Hochelaga.
1337	2300	....	6 930	519656	44 914	Terrebonne to Hochelaga, direct
1387	....	....	5.930	510916	38.942	Terrebonne to Hochelaga *viâ* "St. Vincent de Paul."
650	....	....	1.537	230344	20 940	No. 5—Terrebonne to "Sault au Récollet" *viâ* "St. Vincent de Paul."
....	......	[illegible]00	200	137744	13.774	No. 6—Terrebonne to "Ste. Thérèse" Junction.

	Miles.
Maskinongé to "Bout-de-l'Ile" *viâ* Shore line, No. 1	43.65
" Terrebonne [illegible] line, No [illegible]	47.03

SUMMIT HEIGHT OF GRADES BETWEEN MASKINONGÉ AND TERREBONNE.

No. 1—Shore line	99.00
No. 2—Joliette "	198.00
No. 3—Blue "	100.00
No. 4—Direct "	88.00

APPENDIX No. 7.

ESTIMATES.

Shore Line No. 1 (55.41 miles

Earth excavations— 825.550 @ 28c	$ 231,154
" " — 160.000 @ 28c. to bring grade to 26.4	44,800
Rock " — 403 @ $ 1.00	403
Iron truss bridging— 2.340 Lin. ft. " 85.00	198,900
Wooden " — 750 " 30.00	22.500
1st. Class Masonry—10.821 c. yds. " 14.00	151,494
2nd. " — 4.766 " 7.00	33,362
Rip-rap, in excess of other lines —24.343 c. yds @ $2.00	48,686
12 deep water foundations, Ottawa River,—@ $10,000 each	120,000
146.336 Ties @ 25c	36,584
4.876.08 Tons Steel Rails @ $ 55.00	268,184
277.05 Tons Fish plates, &c. " 85.00	23,549
55.41 miles Track laying " 250.00	13,852
" Ballasting " 650.00	36,017
Total	$1,229,485

Joliette line—*viâ* "Saint Vincent de Paul,"—No. 2. (62.57 miles.)

Earth excavations—1.202.420 c. yds. @ 28c	$ 336,678
Rock " —48.340 " $ 1.00	48,340
1st. Class Masonry—24.700 " 14.00	345,800
2nd. " — 5.506 " 7.00	38,542
4 deep water foundations at "St. Vincent de Paul"—@ $10.000	40,000
Iron truss bridging.—1387 Lin. feet @ $85.00	117,895
Wooden " —1760 " 30.00	52,800
165.184 Ties @ 25c	41,296
5.505.56 Tons steel rails @ $ 55.00	302,805
312.85 Tons Fish plates, &c. " 85.00	26,592
62.57 Miles Track laying " 250.00	15,642
" Ballasting " 650.00	40,671
Extraordinary land damages at "St. Vincent de Paul"	50,000
Total	$1,457,061

Blue Line throughout—*viâ* "St. Vincent de Paul"—No. 3. 60.15 Miles.)

Earth excavations—899.180 c. yds. @ 28 c	$ 251,770
Rock " — 30.190 " " $ 1.00	30,190
1st. Class Masonry— 11.500 " " 14.00	161,000

2nd. Class Masonry—5290 c. yards, @ $7.00	37,030
4 deep water foundations at "St. Vincent de Paul"—@ $10.000.	40,000
Iron truss bridging—1387. Lin. feet @ $85.00	117,895
Wooden " —1100. " " 30.00	33,000
158.796 Ties @ 25 c.	39,699
5290.20 Tons steel Rails @ $ 55.00	290,961
300.75 " Fish plates, &c. " 85.00	25,563
60.15 Miles Track laying " 250.00	15,038
60.15 " Ballasting " 650.00	39,097
Extraordinary land damages at "St Vincent de Paul"	50,000
Total	$1,131,243

Direct Line No. 4—Heavy red.
(58.56 Miles.)

Earth excavations —962.250 c. yds. @ 28 c.	$ 269,430
Iron truss bridging —1387. Lin. feet " $85.00	117,895
Iron trestle viaduct —2300. " " 30.00	69,000
Wooden truss bridging—1100. " " 30.00	33,000
1st. Class Masonry —12.502 c. yds. " 14.00	175,028
2nd. " —5.153 " " 7.00	36,071
4 deep water foundations at "Des Prairies" river @ $10.000	40,000
154.657 Ties @ 25 c.	38,664
5.153.28 Tons steel Rails @ $ 55.00	283,430
292.80 " Fish plates, &c. " 85.00	24,888
58.56 Miles Track laying " 250.00	14,640
58.56 " Ballasting " 650.00	38,064
Total	$1,140,110

Line No. 5 from "Terrebonne to "Sault-au-Récoilet," *via* "Saint Vincent de Paul,"—No. 5.
(11 miles.)

Earthwork —148.290 c. yds. @ 28 c.	$41,521
Rock " —30.190 " " $ 1.00	30,190
1st Class Masonry—1537 c. yds. " 14.00	21,518
2nd " " —970 " " 7.00	6,790
Iron truss bridging —650 Lin. ft. " 85 00	55,250
29.040 Ties " 0.25	7,260
968 Tons steel Rails " 55.00	53,240
55 " Fish Plates " 85.00	4,675
11 Miles Track laying " 250.00	2,750
" " Ballasting " 650.00	7,150
Total	$230,844

"Bout-de-L'Isle" to Hochelaga.
(11.90 miles.)

Earth excavations—143.440 c. yds @ 28 c.	$ 40,163
Iron truss bridging—2340 Lin. ft. " $85.00	198,900
1st Class Masonry—7221 c. yds. " 14.00	101,094
2nd " " —1047 " " " 7.00	7,329
12 deep water foundations at Ottawa river @ $10.000	120,000
31416 Ties @ 25 c	7,854
1.047.20 Tons steel Rails @ $ 55.00	57,596
55.50 " Fish Plates " 85.00	5,057
11.90 Miles Track laying " 250.00	2,975
" " Ballasting " 650.00	7,735
Total	$548,703

Terrebonne to Hochelaga, direct.
(11.56 miles.)

Earth excavations—392.310 c. yds. @ 28c	$ 109,847
Iron truss bridging—1.387 L. ft. " $85.00	117,895
Iron trestle viaduct—2.300 " 30.00	69,000
1st. Class Masonry—6.930 c. yds. " 14.00	97,020
2nd. " —1.020 " 7.00	7,140
4 deep water foundations at "Des Prairies" river, @ $10.000	40,000
30.452 Ties @ 25c	7,613
1.017 Tons steel Rails @ $ 55.00	55,825
57.80 " Fish plates, &c. " 85.00	4,913
11.56 Miles Track laying " 250.00	2,890
" Ballasting " 650.00	7,514
Total	$519,657

Terrebonne to Hochelaga *viâ* "St. Vincent de Paul."
(13.12 miles.)

Earth excavations—329.250 c. yds. @ 28c	$ 92,190
Rock " —30.190 " $ 1.00	30,190
1st. Class Masonry—5.930 " 14.00	83,020
2nd. " —1.154 " 7.00	8,078
4 deep water foundations at "St. Vincent de Paul," @ 10.000.	40,000
Iron truss bridging—1.387 L. ft. @ $85.00	117,895
34.636 Ties @ 25c	8,659
1.154.56 Tons steel Rails @ $ 55.00	63,500
65.60 Tons Fish plates, &c. " 85.00	5,576
13.12 Miles Track laying " 250.00	3,280
" Ballasting " 650.00	8,528
Extraordinary land damages at "St. Vincent de Paul"	50,000
Total	$510,916

Terrebonne to "Ste Thérèse" Junction,—No. 6.
(10 Miles.)

Earth excavations—205,480 c. yds.	@	28c	$57,534
1st Class Masonry—200 c. yds.	"	$14.00	2,800
2nd " " —880 "	"	7.00	6,160
Wooden truss bridging—100 L. ft.	"	30.00	3,000
26400 Ties @ 25c			6,600
880 Tons steel Rails	@	$55.00	48,400
50 " Fish plates, &c	"	85.00	4,250
10 Miles Track laying	"	250.00	2,500
" " Ballasting	"	650.00	6,500
		Total	$137,744

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Copy of a Report from a Committee of the Honorable Executive Council, dated 27th March, 1877, sanctioned by the Lieutenant-Governor, the 29th March, 1877 :—

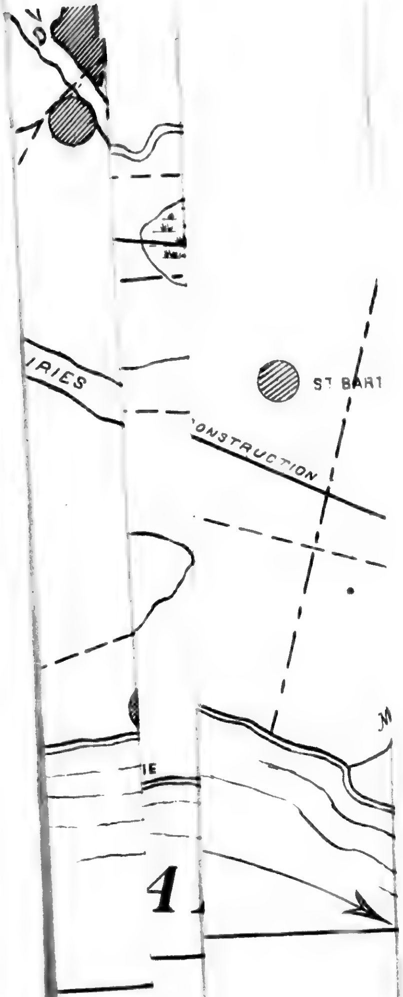
No 102—Respecting the Quebec, Montreal, Ottawa and Occidental Railway : —

The Honorable the Commissionner of Agriculture and Public Works, in a report dated the 27th March instant (1877), sets forth :—That he has taken into consideration the report of the Quebec, Montreal, Ottawa and Occidental Railway Commissionners, dated the twenty-second instant, annexed to his said report, and wherein they express the opinion that, for the several reasons given by Messrs. A. L. Light and Sandford Fleming in their reports respecting the change of the line of this Railway,—the present line of the said Road, between Maskinongé and Montreal, should be abandoned, and that the Road should be built on the line marked number four (4) on the plan annexed to Mr. Light's report,—the said line passing through Terrebonne.

The Honorable the Commissionner recommends, consequently, that the present route of the Quebec, Montreal, Ottawa and Occidental Railway, between Maskinongé and Montreal, be abandoned, and that the said Road be built on the line marked number four (4) on the said plan annexed to Mr. Light's report, from Maskinongé to the town of Terrebonne : the remaining portion of the direction line to be decided upon later on.

The Committee concur in the above report, and submit it for the sanction of the Lieutenant-Governor.

(Certified,) FÉLIX FORTIER,
Clerk Ex. Council.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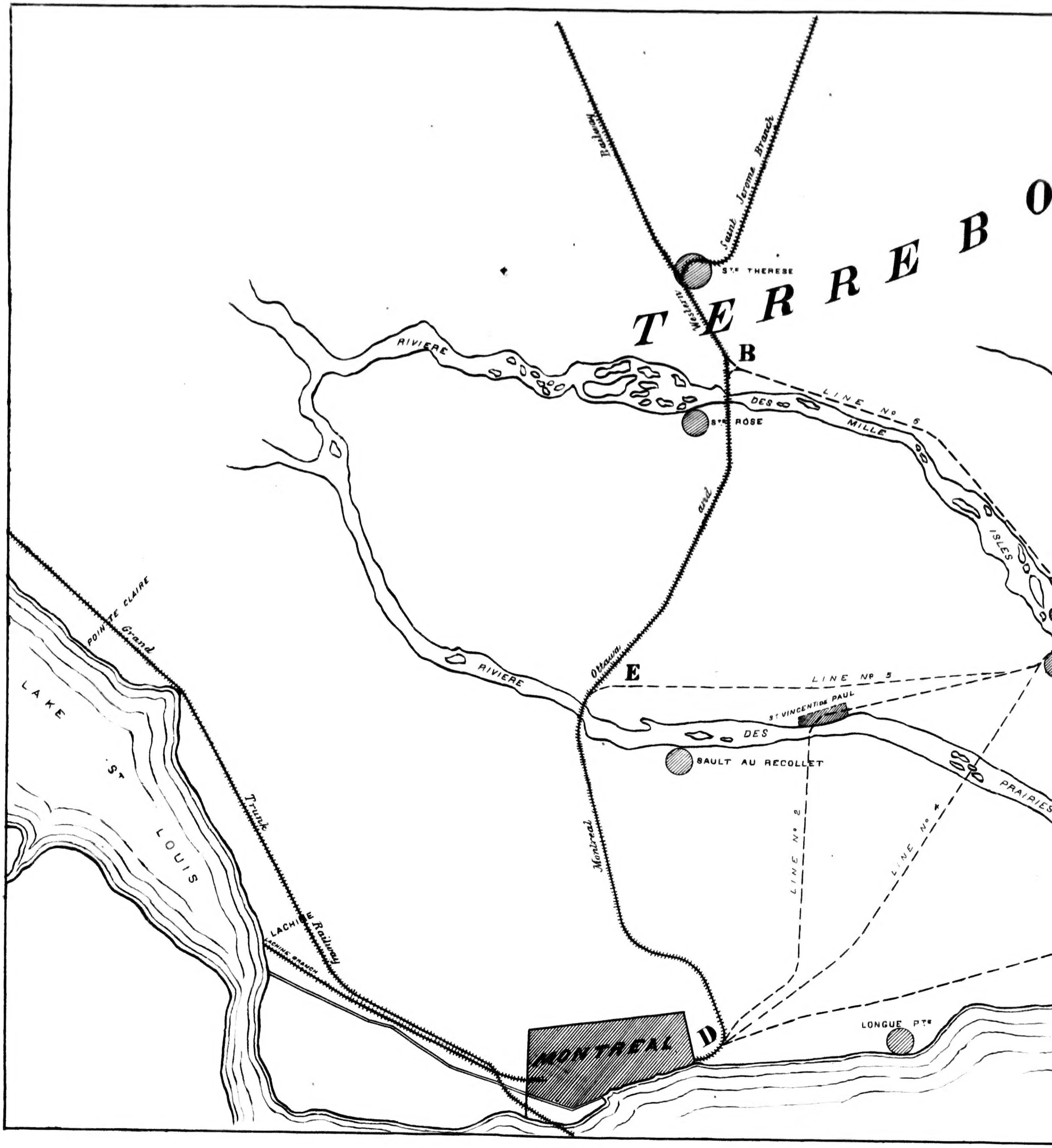
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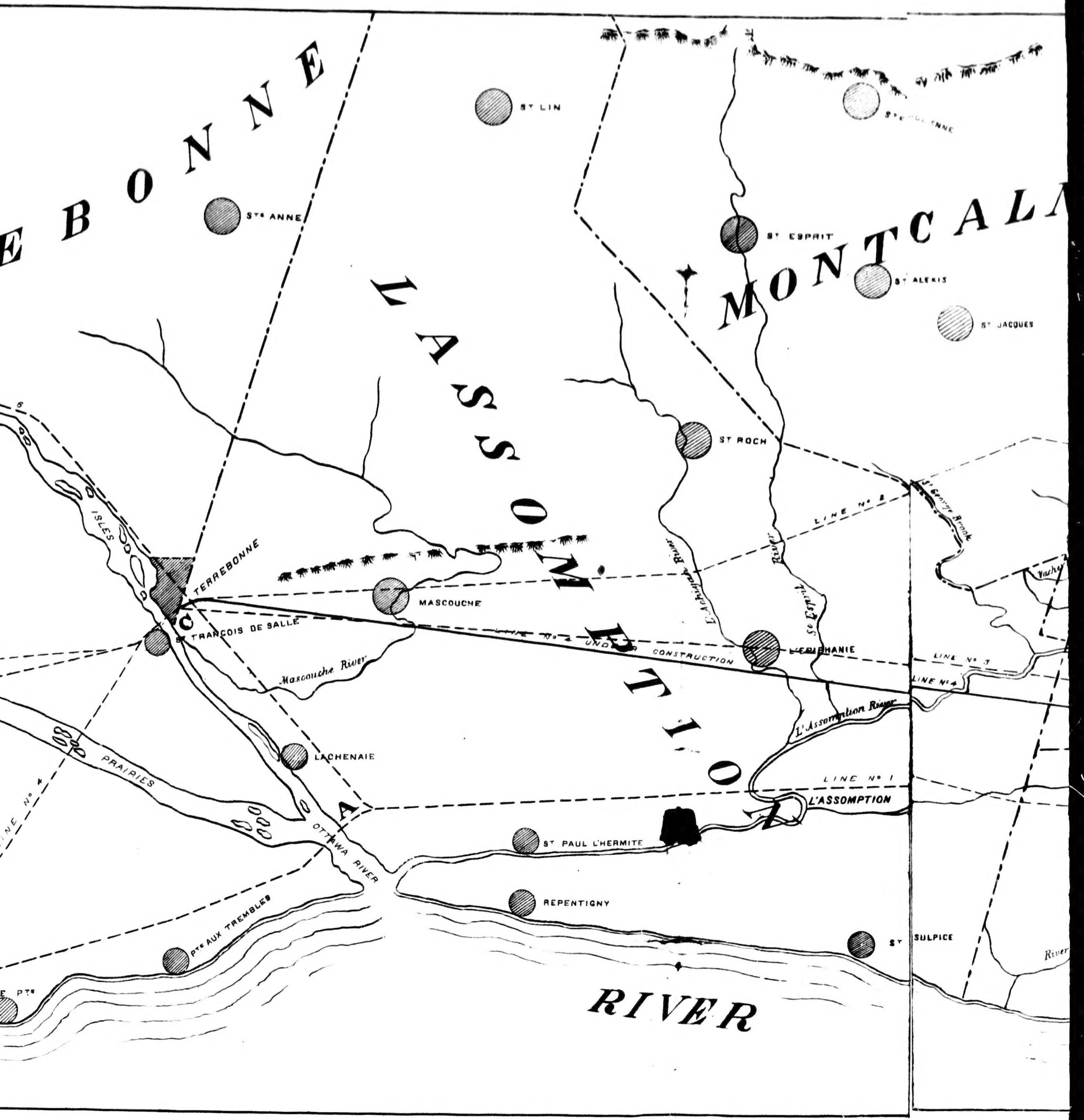

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LINE No 2
LINE No 3
LINE No 4
LINE No 1
L'Achigan River
St Esprit River
St George Brook
Vacher
L'EPIPHANIE
L'Assomption River
L'ASSOMPTION
LACHENAIE
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PRAIRIES
OTTAWA RIVER
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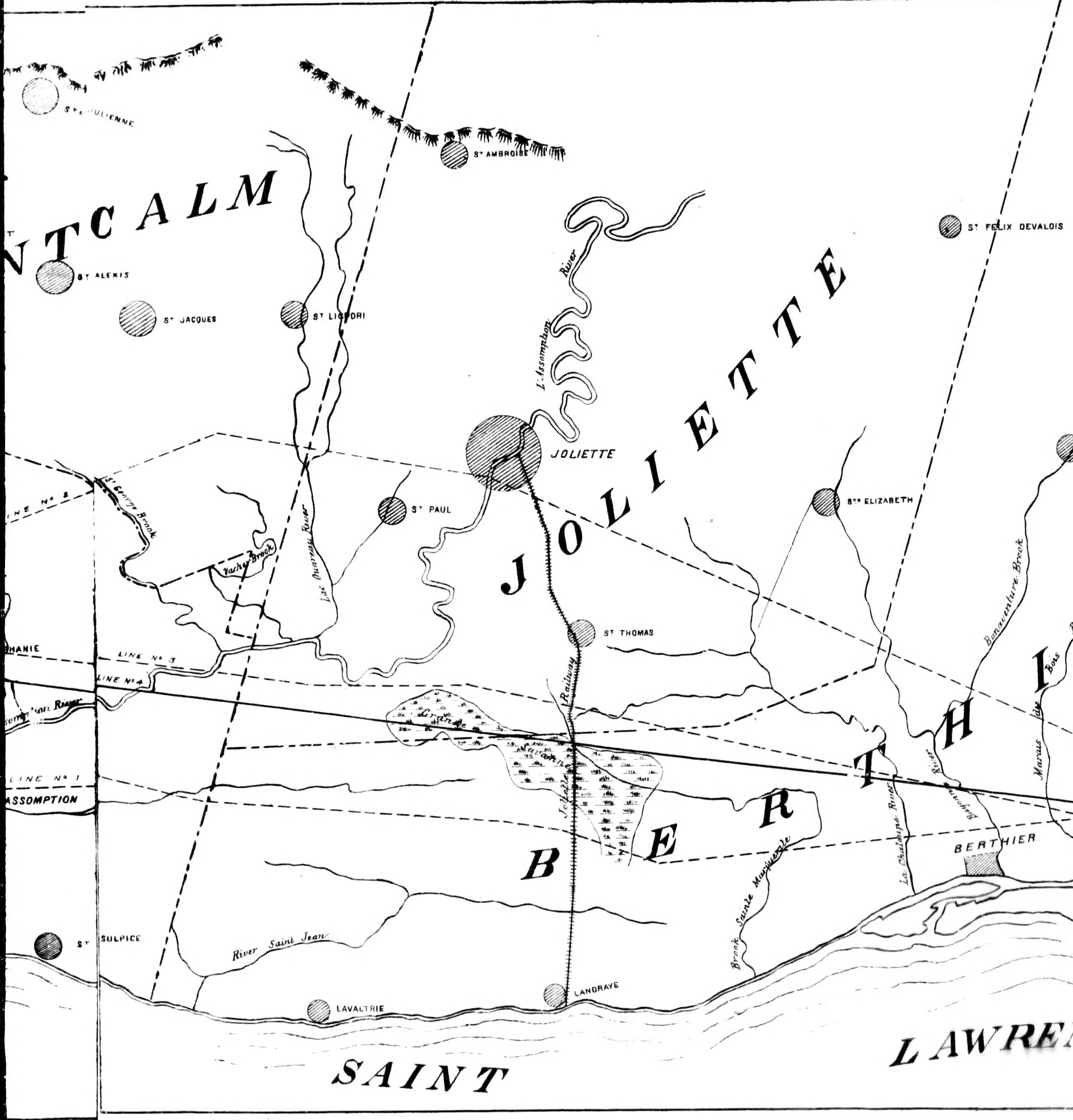
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STE ELIZABETH
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LINE No 2
St George Brook
Vacher Brook
Lac Ouareau River
PHANIE
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ST THOMAS
Railway
Bonaventure Brook
Assomption River
Grande Savanne
Joliette
LINE No 1
ASSOMPTION
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Marais du Bois
Bayonne River
La Chaloupe River
BERTHIER
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ST SULPICE
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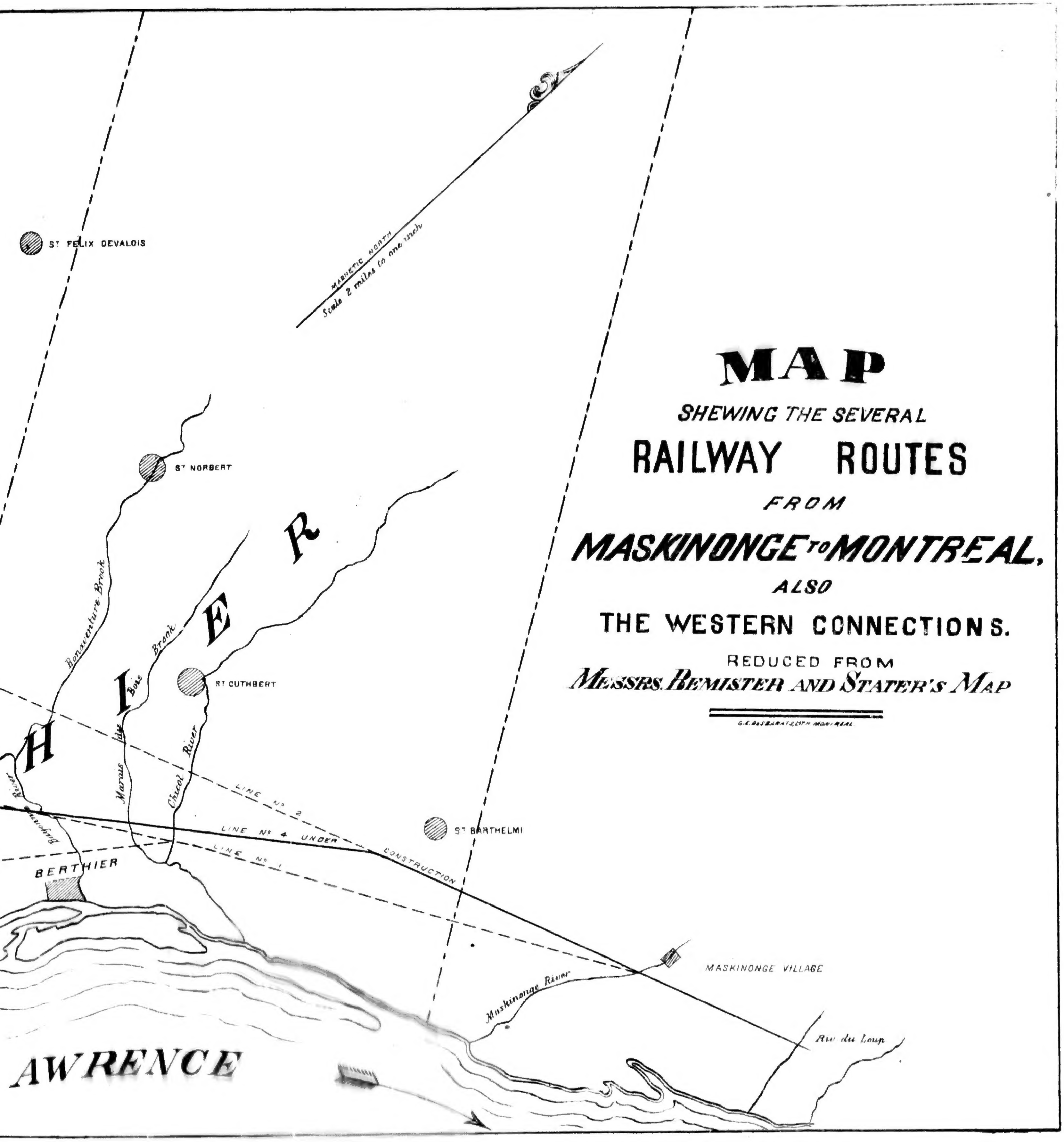

MAP
SHEWING THE SEVERAL
RAILWAY ROUTES
FROM
MASKINONGE TO MONTREAL,
ALSO
THE WESTERN CONNECTIONS.
REDUCED FROM
MESSRS. BEMISTER AND STATER'S MAP

G.E. DESBARATS, LITH MONTREAL